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MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGA...

September 1992

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SEPTEMBER 1992 VOLUME 120, NUMBER 9

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

FEATURES

ABOVE: *the JPX team from France spools up the JPX Turborec T240 propane-powered, turbine jet engine (see Top Gun coverage).*

ON THE COVER: *Mark Frankel's scratch-built, 1/7-scale, glass F4D Skyray (center) takes to the sky with Kerry Sterner at the sticks. Clockwise from top left: Charlie Nelson's 1st-place winning, scratch-built Waco VKS7F; Rich Uravitch's AT-6, flown here by Nick Ziroli Jr.; Chuck Fuller's Super Stearman; David and Tony Malchione's BVM T-33; Dean Digiorgio and Bob Pickney's C-45 Beechcraft; and Roger Young's C-47. All pictures from Top Gun.*

FEATURES

HELICOPTER SECTION

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

NEW COLUMNS, AND MORE...

We're pleased to present two new columns this month. "Simple Programming" by David Baron will show you how to get the most out of the latest extension of the human brain—the computer radio. A modeler for over 25 years, David's interests encompass giant scale, helicopters, electrics, competition fun-flying, soaring, model design and a few other specialty areas. David co-owned a hobby shop for two years, is a multi-engine, commercial/instrument-rated pilot, won fifth place in the 1991 Fun Fly Nats, and has been a valued contributor to (and test pilot for) *Model Airplane News*. If you own or have considered purchasing a programmable radio, this column is for you.

Jef Raskin, a modeler for over 30 years, will be providing well-informed, candid summaries of the better modeling videos in a new column titled "Video Views." He brings many skills to this challenge. Jef was the principal intellect behind the development of the Apple Macintosh computer (he named the computer after his favorite apple). He has taught video production at the University of California and has written scripts and sound tracks for movies, including one broadcast on PBS.

Jef is an avid R/C flier who actively competes in local contests (he has taken a number of first and second places). Living near the unsurpassed slopes of the West Coast, he has developed a particular interest in aerobatic sailplanes. In addition to doing a lot of R/C flying, Jef has manufactured a successful line of sailplanes (Western Wind and Anabats) and published a number of articles on aviation-related technical subjects. He's the newsletter editor for the San Francisco Vultures and also writes a weekly nature/science column in a local newspaper. We think you'll enjoy the insights he brings to "Video Views."

LIMBERING UP

As I write this in the early days of June, I'm getting ready for the upsurge in fun-fly activity that summer brings. In the photos, you can see me starting the O.S. .32 on my Tadpole (published January '92) and practicing touch-and-go's. If you haven't flown one of these "competition fun-fly" aircraft, it may come as a surprise that the plane is able to go vertical immediately after a touch-and-go.

Editor-in-Chief Tom Atwood starts the O.S. .32 on his Tadpole fun-fly airplane while David Baron assists. Below: touch-and-go practice.

PHOTOS BY JAY WEINER

The Tadpole serves well as a trainer. I've crashed mine three times without major injury to the plane. The worst was a downwind, dead-stick stall from about 10 feet of altitude. The stall led to a nose-to-wing impact, a cartwheel in the air and a second frontal impact. The only damage was a disconnected aileron servo lead and a rudder servo that jarred loose from the balsa it was mounted on. Since the Tadpole design is over a year old, it isn't quite as light as the current leading-edge designs, but it makes up for this in stable tracking and ruggedness, which are qualities I appreciate. I haven't really tried to minimize weight; I'm using aluminum landing gear, a 4-ounce fuel tank and a Soundmaster quiet muffler from Davis Diesel of Milford, CT. Also, the design's CG can be moved rearward for tighter loops and slower spins (something I'll do later this season).

One of the challenges with this kind of design is to keep it at a low air speed. Excess speed can lead to tail-surface flutter and failure. We'll be bringing you more on the subject of competition fun-fly airplanes in upcoming issues. Serious competitors—note that the National Competition Fun-Fly Association and *Model Airplane News* are co-sponsoring the '92 Summer National Competition Fun Fly. It will be held September 5 and 6 at Peeler Park Field in Nashville, TN. For more information, contact Doug Whiteaker, CD, 938 Point View Cir., Mt. Juliet, TN 37122; (615) 444-1483.

UNLIMITED OOPS

I received a call from Rob Wood regarding an error that unfortunately crept into his article on the Second R/C Unlimited races (see August *Model Airplane News*). Working hard to meet his deadline, Rob inadvertently juggled the names of the Bronze winners. Winners were: 1st, Duke Crow; 2nd, Adam Gelbart; 3rd, Charlie Beverson. We regret the error.

GROWING THE HOBBY

We continue to hear bits of good news about various efforts to involve young people in R/C aeromodeling. Doug Stead of the Royal Canadian Air Cadets (a military group that's somewhat analogous to our Civil Air Patrol) has described a program sponsored by the Cadets in which approximately 50 kids are building over a dozen 100-inch R/C aircraft. The Air Cadets program involves something on the order of 25,000 kids across Canada, and if Doug's program works out, he feels many of the other Cadet programs will want to adopt his program. We wish you all success Doug!

Finally, I want to acknowledge the innovative guarantee U.S. AirCore has made to purchasers of its AirCore 40 Family Trainer. U.S. AirCore states: "If you crash and destroy your AirCore 40 Family Trainer before you learn to solo, we'll replace it, free." There is some fine print: there must be an AMA-club designated instructor present at an AMA-approved club, and the "unrepairable" plane must be returned with a signed warranty. We applaud such programs. ■

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ARABIAN FLIGHTS

I recently bought my first 4-stroker—an O.S. .40 FS Surpass. With a wooden 12x6 propeller installed on my scratch-built Commando, I started my first break-in. As soon as I opened it to full throttle, I heard "pings." It scared me. I stopped the engine, opened the rear cover plate and checked for foreign particles. Nothing! I opened the rocker cover to look for binding; no help. I even re-adjusted the valve clearance. As soon as I opened the throttle, I again realized that detonation, or "pre-ignition, was taking place. I just couldn't go more than half throttle.

After two tanks, I thought of giving it an in-flight break-in. The light model took off at half throttle with no problem. After a couple of flights, I tried it again on the ground. I opened up the throttle and, with one "ping," before I realized what was happening, the prop flew away with the spinner nut, and they landed about 100 feet away. Luckily, no one was hurt. I thought my engine was gone. After fixing the prop and firing the engine again, all sounded normal.

I asked my club fellows, but nobody had experienced this problem. I went through my copy of "Model Four Stroke Engines" (an Air Age publication). On page 92, it describes thrown props. This is exactly my problem. I don't want to use the prop-locking method to secure it, as it may damage my expensive engine. I've even tried a fiberglass prop, no-nitro fuel and another type of glow plug. Any suggestions?

NARENDRA JAVA
Sharjah, United Arab Emirates

It's possible that your O.S. .40 Surpass ended up with higher compression owing to some manufacturing fluke, e.g., an incorrectly machined piston-sleeve flange, or an incorrect head shim/gasket, but this is extremely unlikely. Your prop was just too large for an engine this size. Not only this, but the engine was also new and running at higher than usual operating temperatures, which further exacerbated the pre-ignition problem.

Try this. Stick with the 5-percent-nitro fuel. I hope you have at least 18 percent lubricant; even 20 percent is good for break-in. Put on a 10x6 or 10x7 wooden prop, and run through a tank of rich fuel with the airplane on the ground. Lean-out the engine for just a few seconds, then quickly return to a rich setting for a cool-down period of 40 seconds to a minute. Repeat this brief leaning-out and then returning to rich for a full tank's worth of running. Now fly half-a-dozen or so flights with a rich mixture to keep rpm down. Continue to use a 10x6 or 10x7 prop (nothing larger) for this stage of run-in.

The prop sizes I'm recommending might sound small to you, but the model you've put the O.S. in is a "floater," and these props will be quite enough to fly it safely.

After break-in, switch to an 11x6 prop; I'm sure you'll have good results with this size. Also try a 12x5, but remember, the Surpass Series engines are higher-revving engines than the first generation of 4-strokes and, because of their higher compression ratios, they don't take to loading down as well as older designs did. Even after break-in, you may still find that the 12x6 induces detonation and prop throwing. CC

HATS OFF TO FLIGHT INSTRUCTORS

I'm writing to tell you about a man in our R/C club. His name is Richard Evans, and he's really something special. I joined the club, not knowing anyone, and as a new pilot without any experience flying R/C planes. I quickly found that you need an instructor or, chances are, you won't have your airplane very long. Well, trying to find an instructor isn't as easy as it sounds. Don't take me wrong. Any of the experienced pilots will help you, but not every-

one wants to be an instructor. They'll teach you, but they just don't like to be responsible for wrecking your plane. To my way of thinking, that's a chance you have to take when you're new at flying. Sometimes, you crash and burn. And if you do, go back and build another one.

Anyway, Richard is always willing to teach anyone who asks. And he does it with a smile. And he's one hell of a pilot. He has saved my PT-40 from almost certain disaster. I'd like you to sing his praises. He really deserves a pat on the back, because he's a perfect example of a goodwill ambassador of R/C Flying.

SONNY VAN CLEAVE
Dover, KS

Sonny, thanks for taking the time to recognize your instructor. It's true that there aren't too many people who want to take the responsibility for someone else's airplane. You're correct in that, if you don't get instruction, you can expect the destruction of your model sooner or later. We've published many articles on the benefits of flight instruction, and we still think it's the best way to bring new people into the hobby and thereby keep it going.

It's inevitable that, even with the best instruction, models will crash. The best way to look at this is that crashes help you to develop your building skills. If someone does offer you valuable instruction, consider it an even tradeoff if, during instruction, the model is damaged. Thanks for your comments and encouragement to other flight instructors! GY

RADIO FEEDBACK

I've become friends with someone who has been modeling for 55 years and who has saved me years of trial and error, especially in my scratch-building endeavors. He advised me not to allow a metal control rod—cable or music wire—to come close to the antenna, even if both are shielded with insulation or nylon. Is this a potential problem and, if so, what advice can you offer?

More color photos! I get my best paint jobs from ideas in your mag.

DAVE BORG
Girard, PA

(Continued on page 10)

AIRWAVES

It's true that all of us can benefit from the experiences of others, if we only pay attention. Someone with 55 years experience is likely to see a potential problem. As for the radio-interference problems caused by the presence of metal control rods: in the past, older radios had a low tolerance for "mechanical noise" (i.e., radio interference) caused by metal parts touching. Also, metal touching the antenna can effectively change the radio's tuned length, and this won't help the radio's performance.

The newer radios are much more "tightly" tuned, and the problem of mechanical noise has almost completely disappeared. It's still a good practice to keep your receiver antenna away from the model's metal parts (especially the servo-wire leads) and to avoid mechanical arrangements that will lead to this.

GY

A DEEPER LOOK AT DESIGN

This is just a "vote-note" to thank you for running the Andy Lennon series of articles. I really enjoyed them as relief from the "beginner pabulum" and the "how to build an ARF" articles. I realize that you have a very wide audience to satisfy, but the modelers who stick with the hobby are interested in the technical side of things. I particularly look forward to the latest from Chris Chianelli's "Air Scoop" column.

DICK SCHWIEREN
Burns, OR

Thanks for your letter, Dick. We've received many such comments on Andy's series, and we plan to continue publishing his contributions to model design and related topics. Andy has been reading Model Airplane News for several decades, and we're honored to have him as a contributor. (In this issue, he discusses stressed-skins.)

Chris Chianelli gets the scoop on products that haven't yet reached the U.S. (he was recently in Japan), and some that may never make it here. He doesn't just depend on his own globetrotting. If any readers have leads for "Air Scoop," please write or fax Chris. He may ask you to follow up with some color pictures! TA

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

From Trees to Pylons

Attention unlimited-race nuts! Are you aware of power-saw racing? It's a log-cutting event using chain saws. Bear with me. Eleven-time World Champion lumberjack Mel Lentz is causing serious problems for the Canadian contenders. They use mostly Huskys; he uses an engine called the STIHL 7.4, which has been modified by 15-year veteran builder/mechanic James George of Monroe, LA.

According to James, when the Canadians changed the rules only one week prior to an event, he built a new version and "air-expressed" it to Mel. Mel became the first to win with the STIHL engine at the prestigious PNE (Pacific NW Exposition) show, at which can be found Canada's largest and oldest log-cutting competition.

James is now putting this awesome power at the fingertips of unlimited racers. Last year, Stinger Wallace would have been a serious threat with his no. 74 had he not had landing-gear problems. With this year's more powerful version of the STIHL 7.4,

James predicts speeds of over 160mph! If you're interested, contact James George, Monster Motors, 417 E. Ironwood Dr., W. Monroe, LA 71291; (318)-396-7081.

DREAMING DOGS

The Horndog Racing Team. That's the name! Check the shirt logos with your "Scoop"-loops if you don't believe me. They're doing some drooling over a full-scale AT-6. This isn't an idle trance the boys are caught in; no, they're collecting vital scale-detail information to use on their R/C AT-6 racers for the upcoming AT-6 and Unlimited Race event this September 23 to 27 in Madera, CA. If you wish to go to Madera and root for the Horndog Racing Team, or steal their bone, contact Endless Horizons, c/o Lesley Burnett, P.O. Box X, Torrance, CA 90507; (310) 320-8369; fax (310) 320-8354.

GIANT TRAX

The Airtrax .46 and .61, which have been dubbed by many as "the Sticks of the 21st Century," have a new stablemate: the Airtrax 3.0. The new addition is designed for a 2.6 to 4.2 gas engine; it has an 84-inch span, 1,300 square inches of area and an estimated flying weight of 16 to 17 pounds. The kit comes 75-percent built, and it includes carbon-fiber spars.

L&R Aircraft, 13645 Fisher Rd., Burton, OH 44021; (216) 834-1578.

AIR SCOOP

Serious Fun

In the fun-fly community, David Baron (on left) and Russ Pribanic are a noted test-pilot/inventor team. Pictured are just a few of the projects these two have been working on at their Lower New England Skunkworks.

Top: Dave and Russ do a final tweaking of the O.S. .28-powered design that has a rotor-controlled pitch axis. Machine-shop wizard Russ has worked out the drive shaft

so that it runs directly off the crank, out through the engine backplate and inside the arrow-shaft fuselage. Russ has also reduced the weight of a GMP Cricket tail rotor by about 50 percent and uses cut-down reinforced nylon blades to handle the higher operating speeds of about 11,000 to 12,000rpm. As I understand, a version that uses the rotor in the yaw axis is capable of an unrivaled, and fully recoverable, flat spin.

Above left: Russ devised a split vertical stab to investigate the benefits, if any, of placing a braking mechanism on this part of the airframe. In flight tests, Dave found that the device created an "air bubble" over the horizontal stab, causing the tail to pitch upward and make flares difficult. The next version will have a hinge line that's angled back toward the rear to produce a possible up-elevator effect.

Below: to date, this is the biggest success the guys have had. Incorporating full-flying vertical and horizontal stabilizers seems a very good way of getting high deflection while reducing turbulence. Not only do the airfoil-shaped surfaces help keep air speed under control—a plus in fun-fly events—but, according to Dave, the flying stab also gives flawlessly round loops. Both surfaces pivot at 33 percent of the chord (measured at the root) back from the leading edge. Will full-flying wings replace ailerons? Did servo-reversing replace wildly bent control-linkage rods? Probably.

Electro-batics

Designer and owner of Aerocraft Model Mfg. Co. Craig Wagner poses for the camera with his latest release, the Apache. Incorporating lightness and low-drag aerodynamics, the Apache is designed for all-out performance with an 05 motor and seven cells, but it may also be powered by .09 to .15 glow engines. The 340-square-inch wing features a semi-symmetrical airfoil that's flat-bottomed at the tips, giving this tiny pattern ship both low drag and a wide speed envelope. Other interesting features are an under-wing scoop that cools and houses the motor batteries and makes between-flight battery changes a snap. The kit includes die-cut and machine-cut parts (hand-selected balsa), rolled plans and a high-quality hardware pack. Price $59.95.

Aerocraft Model Mfg. Co., P.O. Box 553, East Northport, NY 11731; (516) 754-6628.

How Will It Perform?

Want to know how your ultimate electric will perform *before* you've built it? Aero*Comp software from USR&D Corp. provides "performance characterizations" of the electric aircraft that are still a gleam in your eye. Written by physicists/modelers, the program solves mathematical equations that take into account motor performance and aerodynamics. You enter wing dimensions (including tapers, chords, thickness), aircraft weight, runway surface (water, gravel, grass, etc.), prop parameters, motors (choose from the list, or enter your own motor test data), and battery number and capacity. Out comes takeoff rpm, motor current and voltage, climb rate, thrust duration at full throttle or stall speed, and other performance characteristics. Some of the fun will be beating the predictions of the program, which was conservatively written. A full review will appear in a future issue. If you can't wait, contact USR&D Corp., P.O. Box 561, Denville, NJ 07834-0561. The intro price—applicable before October 1—is $79.

FUN IN THE FAR EAST

The Lark is the Oriental answer to lift in the yaw axis! Reports are that knife-edge performance is very important in certain fun-fly events in Japan and other parts of the Far East. It's fairly obvious the Lark will have little problem performing inside and outside knife-edge loops, but ...wait a minute...which direction is "in," and which is "out"?! No matter; both are executed while the plane is on its side; whether it's in or out. *Designer's warning*: do *not* taxi the Lark across bridges in windy conditions; it could be blown off!

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

by AL YEAGLE

Author (left) and David Baron after a test flight.

I'VE BEEN designing, building and flying R/C model airplanes for more than 30 years. My models are simple designs that go together quickly, perform well and are easy to fly. When I moved to Connecticut in 1986, I found that I had even less time to build and fly, so I decided to give electrics a try.

My first venture involved an ARF. It flew miserably, but I was impressed with the power of the electric motor. I immediately designed my own using the power train from the ARF. It flew really well. Then I started fooling around with prop sizes, the gear ratio on the can motor and the size of the battery pack, in an effort to constantly improve performance. As a result, I've discarded my gas-powered planes and I'm 100-percent into electrics.

Quiet power

PHOTOS BY AL YEAGLE & TOM ATWOOD

Whizpurr 40

With electrics, there's little noise and no fuel-soaked air frame that's slowly disintegrating from piston vibration. Just charge the batteries, and you can fly almost anywhere, anytime. You can even stop the motor in midair and restart it at will. The down side, of course, is the weight of the batteries. It's the same problem that we faced in the "old days" with 45V receiver B-cell batteries, but it's easy to resolve with a well-designed plane and careful wood selection. Because there's no vibration, you can also use a lighter airframe.

Initially, electric airplanes were powered gliders. My interests lean more toward sport planes, so I experimented with designs for 05- and 15-powered planes. They all used geared motors and flew well with good duration.

I wanted to build the Whizpurr 40 to gain experience with larger electric motors and to produce an airplane that would perform as well as Bob Kopski's large Skyvolt. I scaled my .15-powered Whizpurr up to what I thought was the best size for a 40 (a wing area of 800 square inches and a weight of 6 1/2 to 7 pounds) and started construction. On a whim, I bought a geared Astro Cobalt* 40 FAI instead of the standard 40. When I ran it with 18 cells in the test stand, it produced more than 5 pounds of thrust at 850 watts using a Zinger* 14x10 prop. Wow!

With this power combination at full throttle, the Whizpurr's performance is spectacular. The climb is better than 1,000 feet per minute, and vertical figure-8s from the bottom up are a snap.

Because of its low wing loading, the Whizpurr flies like an aileron trainer when it's at reduced power. Its short moments and low-aspect surfaces make for good control responses at all speeds. The plane has no bad habits whatsoever. A standard geared 40 is more than adequate power for this airplane.

CONSTRUCTION

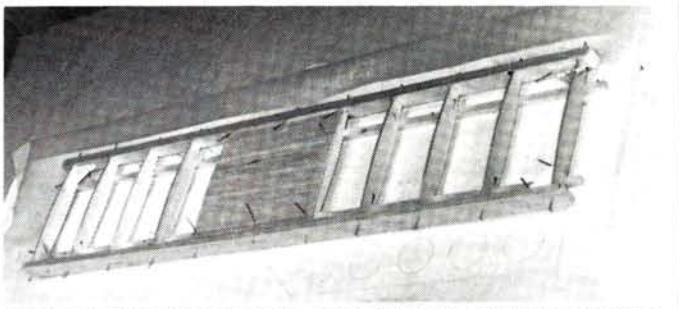
The Whizpurr isn't difficult to build, but there are a couple of things to keep in mind. First, weight is critical to good performance, so careful attention to wood selection is necessary. The only areas in which I didn't use contest balsa (density 4 to 6 pounds per cubic foot) were the wing spars (hard balsa) and the fuselage sides (straight-grained medium). I cut all wing and tail edges oversize in thickness from soft sheet stock to allow for warpage. Those pieces were glued on without inducing any stress and then trimmed to final size. This produced straight, warp-free surfaces.

The main fuselage formers are made of three layers of 1/16-inch balsa that I laminated together with aliphatic resin. To do this, alternate the grain direction in alternate layers. After you've glued the pieces together, weigh them down and let them dry for 24 hours. The resulting balsa plywood is very strong and light.

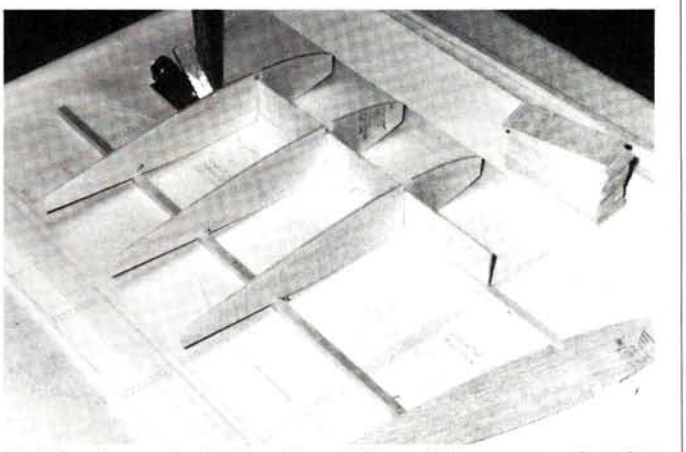
I usually cut all the parts first. To speed up the process, I make plywood templates for the wing, aileron and stab ribs. Cut the spar webs from a 3/32-inch-thick, 3-inch-wide piece of balsa.

WINGS

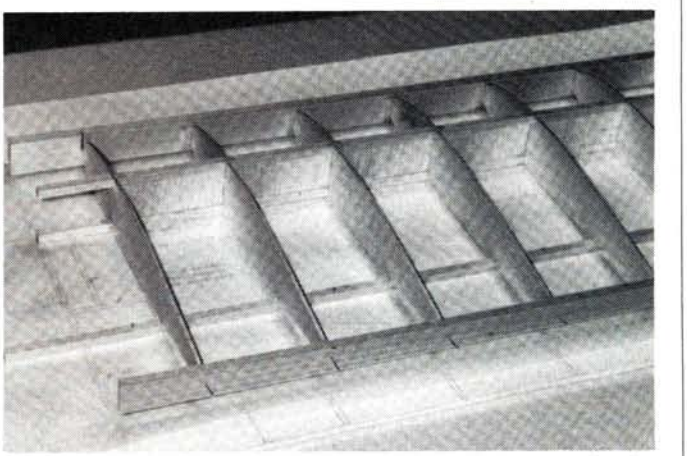
Begin assembly with the wing. Pin the bottom spar and the rib-support strip on the plans. Leave them a little long. Any variation in the spar webs will affect the wingspan, but don't be too concerned about a small variation. The main thing is that the



The stabilizer is built over the plans. The center section sheeting is glued into place before the stab is removed. Note the use of the 1/4-inch square rib jig strips.



Start the wing construction from the root. Glue a rib, then a spar web, and so on to the tip for a strong, tight assembly.



Use CA to glue the edges and the top spar in place before you remove the wing from the building board.

Wingspan: 66 1/2 inches
Wing chord: 12 inches
Wing area: 787 square inches
Airfoil: NACA 2415
Wing loading: 19 ounces per square foot
Stab span: 23 inches
Stab chord, including elevators: 7 1/4 inches
Stab area, including elevators: 162 square inches
Stab airfoil: Symmetrical
Length: 48 inches
Weight (ready to fly): 104 ounces
Controls: 4 channels (rudder, elevator, motor, aileron)
Motor: Geared Astro Cobalt 40 FAI
Batteries: 18 1400mAh SCRs

SPECIFICATIONS

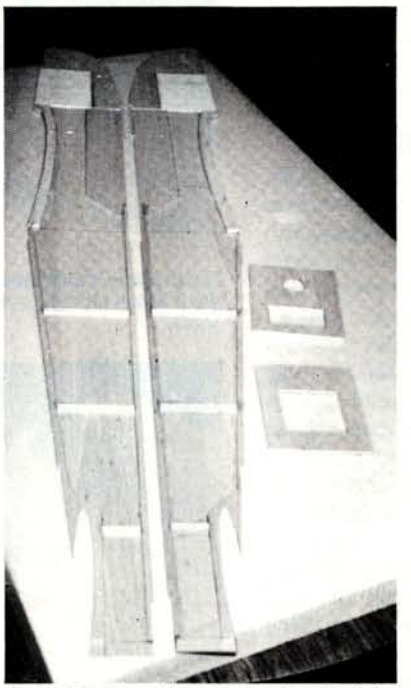
Prop: Zinger 14-10
Speed controller: Jomar SM-4
Power: 850 watts
Thrust: More than 5 pounds

wing panels should be the same length. Starting at the root, glue in a rib, then a spar web and so on, out to the tip. Use CA when you install the top spar and the leading and trailing edges. Now build the other wing panel the same way. Make sure that you build one left panel and one right panel.

Trim the spars at the root, and use slow epoxy to glue the two panels together (use epoxy on the braces). Be very careful here with alignment, as the "trueness" of the wing depends on this joint. When the epoxy dries, add the 1/16-inch balsa sheeting, the cap strips and the 3/16-inch wing tip to the wing, trim the edges to shape and rough-sand the entire structure. Tack-glue the aileron center in place, "fill in" the blocks and trim to shape.

Pin the stab jig strips to the plan. Add an extra 1/16-inch strip for the undersize center section ribs. Pin the ribs in place using a straightedge for alignment. Install (but don't glue) a piece of wood of the same thickness as the fin between the center ribs keeping good vertical and front to back alignment.

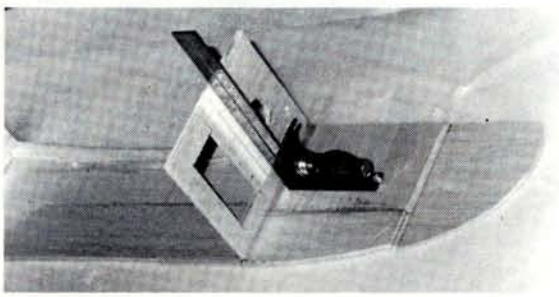
Glue both edges and the center top sheeting in place. Remove them from the plan, and add the bottom sheeting and the wing tips. Trim the edges to shape and sand them and use masking to protect the ribs. Cut the 1/4x2-inch tapered elevator to length. Notch the leading edge at the center to clear the fuselage. Install the 3/32-inch piano-wire joiner with epoxy. After it has dried, finish cutting the elevator to size. Add lightening holes, and cut away the stab top sheeting between the center ribs for the fin.



Glue all doublers, longerons and verticals in place on each fuselage side while it's pinned to the building board.

AILERONS

Cut two pieces of 1/16-inch balsa sheet to size for the ailerons, and mark the rib positions. Pin it down, add the ribs, the leading edge and the root fill-in blocks. Remove this assembly from the board, sand the top to shape and pin it down again, gluing the top sheet in place. Remove the aileron from the board, sand the leading edge to shape and install your favorite aileron cranks.

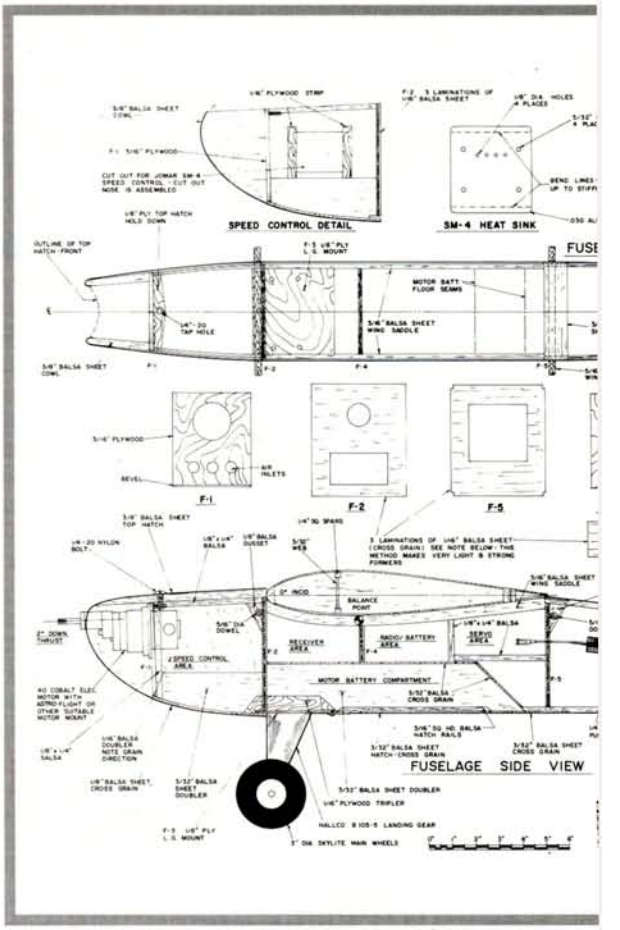


Attach formers F-2 and F-5 to the fuselage side that's pinned to the board. Use a square to align the formers.

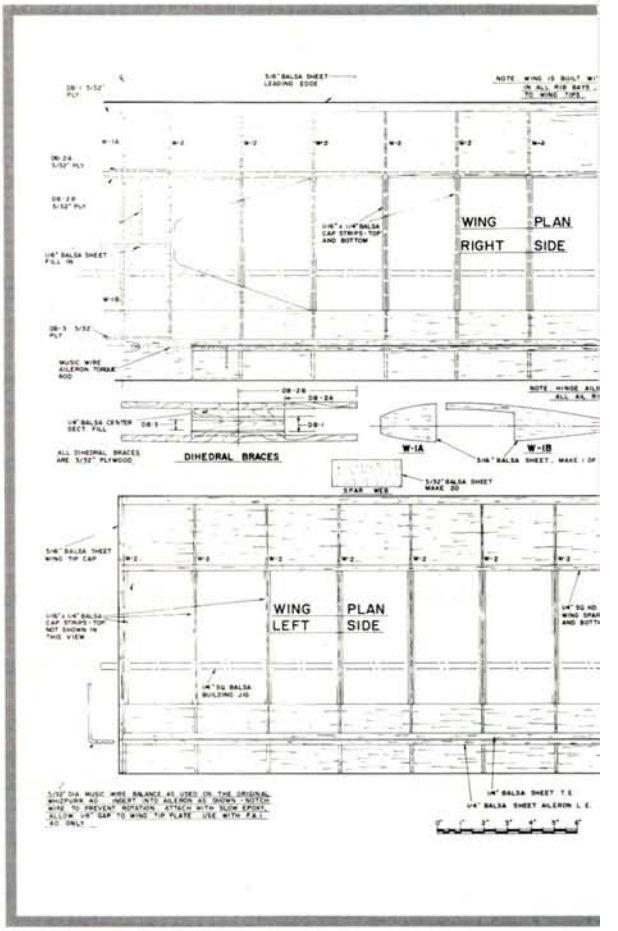
FUSELAGE

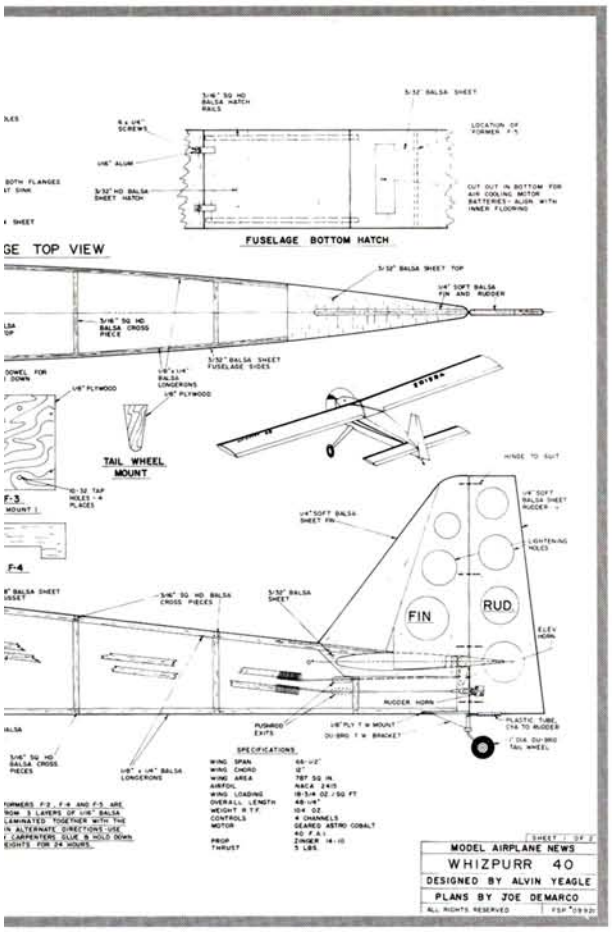
Lay out the left and right fuselage sides. Add all doublers, longerons and verticals using slow-setting CA. Note that F-3 is notched into the doubler but not the fuselage side. Add formers F-2 and F-5 to one side using a square for alignment. Use epoxy to add F-3. Add the sub floor and F-4. Pull the tail together and join using a beveled post. Add all crosspieces and sheeting from the wing back.

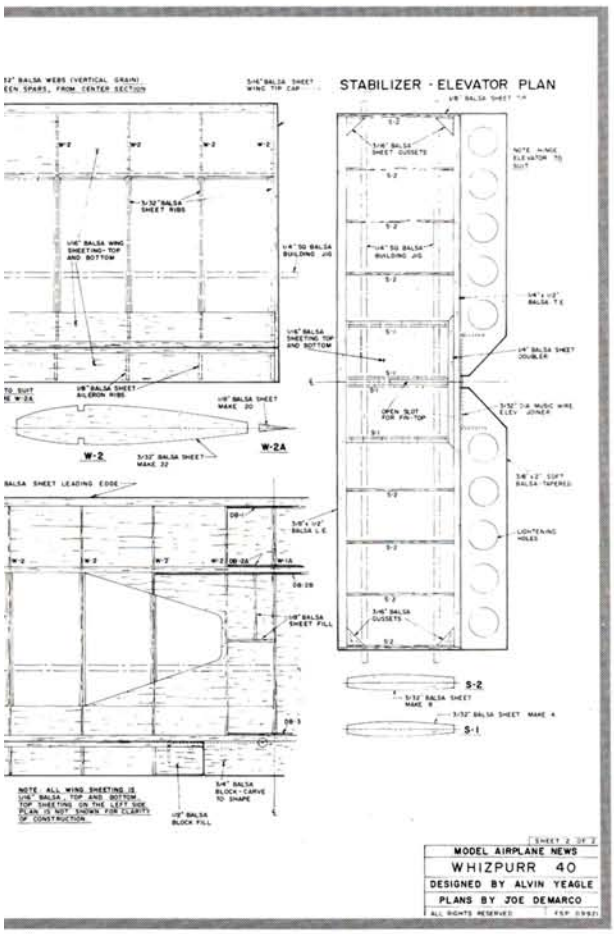
Dampen the sides of the nose section, pull them together, and install the firewall with slow epoxy. When it has dried, add the 3/8-inch-thick nose doublers, the 1/4x1/8-inch strips in the hatch compartment and the 1/8-inch ply hatch hold-down block. Place the 3/8-inch hatch on top of the fuselage, and mark the outline of the compartment through the bottom. Glue 3/16-inch strips to the hatch cover to align the hatch on the fuselage. Glue the

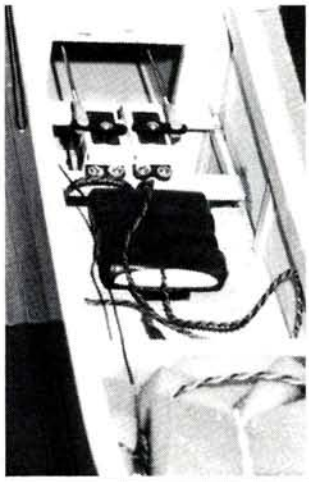


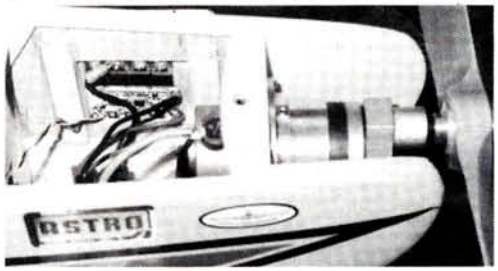
Order the full-size plans on page 111

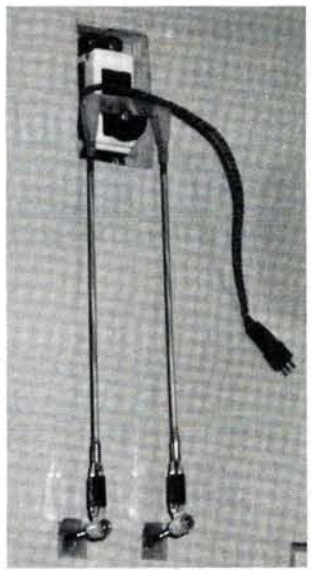


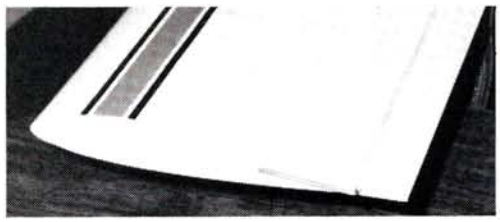












Top left: install the motor as shown using your favorite motor mount. ■ Top right: install the radio as shown. The battery pack is held in place with Velcro®. ■ Above: install the motor wiring and speed controller in the compartment behind the motor. A removable hatch cover allows easy access. ■ Below: the aileron balance was added to prevent aileron flutter at high speeds. ■ Right: the aileron servo installation is in the underside of the wing center section.

1/8-inch bottom nose sheeting in place. After it has dried, place the hatch cover on the fuselage, and trim the nose section to shape. Make a battery-compartment hatch. Drill all holes for screws and dowels, and sand the fuselage to shape.

FINAL ASSEMBLY

Assemble the 1/4-inch sheet pieces for the fin and rudder, add the lightening holes and sand. I glued the fin and stab to the fuselage before I covered it with Super MonoKote*, and I hinged the control surfaces with Sig* Easy Hinges after I had covered the fuselage.

Install the 1/4-inch-square balsa pushrods, the 1/8-inch-ply servo rails and the servos. Install the motor, wiring and throttle control as shown on the plans. I used a custom aluminum mount for the motor. The plans show the installation of the early version Jomar* SM-4 speed controller. The main landing gear comprises a Hallco* B105-5 and 3-inch wheels. The tail wheel consists of a Du-Bro* medium bracket and a 1-inch Du-Bro tail wheel. I used Velcro® on all the battery installations. Try to balance the plane without the motor batteries. This gives you some flexibility in the size and type of the battery packs.

AT THE FIELD

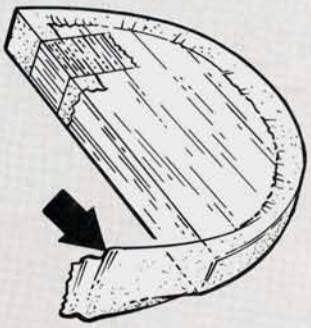
The first flight of the Whizpurr 40 was on a chilly spring day with a little breeze. The plane flew straight off the drawing board, and it required very little right rudder trim. With the built-in downthrust, a fair amount of up-elevator is required to get airborne. During its first flight at full throttle, the plane made some weird noises, and I thought something was loose. I landed it and checked everything out, but nothing was wrong. I took off again, and the same thing occurred. I made a low pass at full speed and discovered that the

(Continued on page 78)

HINTS & KINKS

JIM NEWMAN

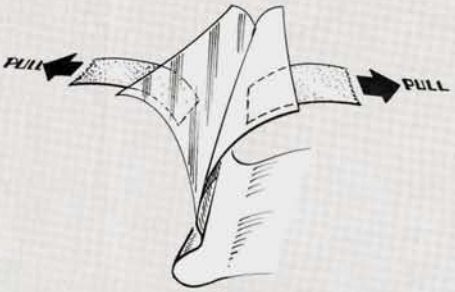
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



TEFLON GLUE BARRIER

To prevent laminated strips from sticking to the molding or the forming block when you laminate wing tips, try this. Wrap a strip of Teflon pipe tape (available at hardware stores) around the edge of the block, and secure the ends of it with masking tape as shown.

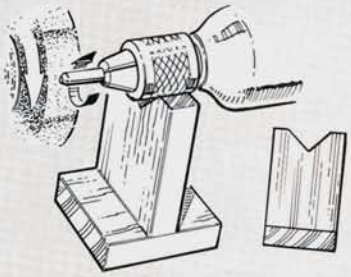
Dave Kovensky, Albuquerque, NM



REMOVE COVERING-FILM BACKING

Put pieces of masking tape on the covering film and its clear backing. To separate the backing from the film, just pull the pieces of tape.

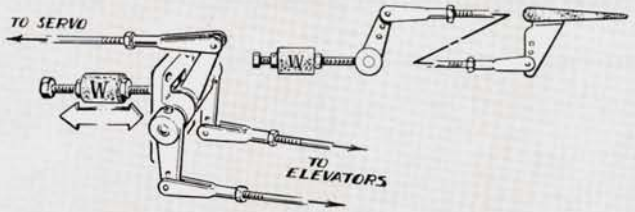
Steve Gurley, Tempe, AZ



TOOL REST FOR GRINDING

This wooden rest will hold rods, bolt heads, etc., level with the grinding wheel's horizontal center line so that you can shape them properly. Just secure the part in a drill chuck, and shape it while you rest the chuck in the "V-block." (Be sure to wear safety goggles.)

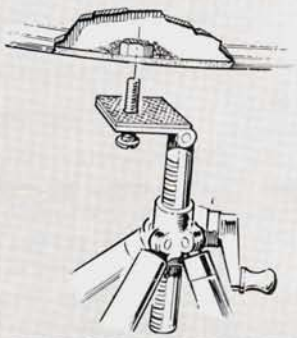
Bob Robert, Durrington, Wilts, England



INTERNAL COUNTERBALANCE

Here's a way to relieve the elevator servo of the elevator's heavy surface load. This setup is especially good for giant models, which don't usually have external counterbalances. To prevent flutter, be sure to keep slop out of the pivots.

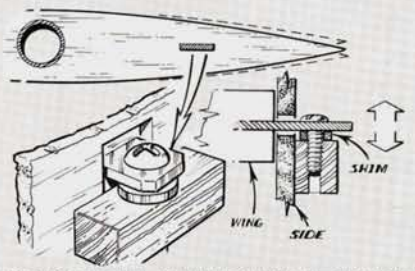
Art Perry, Reisterstown, MD



TRIPOD WORK STAND

Why not use a camera tripod to hold your sailplane while you work on it? Find a nut that will accept the tripod's mounting screw, and secure it to the bottom of the fuselage using fiberglass resin. (Be sure to protect the nut's threads with clay or soap before you apply the resin.) Then drill a hole of the appropirate size in the fuselage, and mount the plane on the tripod.

George Voss, Oklahoma City, OK



VARIABLE WING INCIDENCE

This tip will enable you to adjust the wing incidence on some planes without deflecting the ailerons and creating trim drag. The wings of large models are often attached to the fuselage with aluminum tubes, and this enables them to pivot. Mount a metal tab on each wing's trailing edge, and cut mounting slots in the fuselage that are slightly wider than the tab. To alter the incidence, just install shim washers of various thicknesses as shown. (Metal washers work well, but you can also make your own out of plywood.) This setup will also enable you to adjust the pitch trim; just raise or lower both trailing edges equally.

Bjarte Oygard, Sandane, Norway

PUBLISHER'S PAGE

LOUIS V. DeFRANCESCO

TOP GUN
INVESTING IN THE FUTURE

It has been, and always will be, *Model Airplane News's* mission to invest in the future of our hobby. One of the ways we do that is by sponsoring events that will not only be of tremendous interest to avid R/C enthusiasts, but will also raise the public's awareness of radio-controlled flight.

The Top Gun Invitational scale extravaganza sponsored by *Model Airplane News* and Pacer Technology is such an event. There are those who, by their attitude, would seem to prefer to keep aeromodeling shrouded in mystery—only for those who have "earned" the right to partake. With the ever-increasing problem of the loss of flying fields and frequencies, this attitude is obviously a dead-end street.

Publisher, Louis DeFrancesco and Top Gun promoter Frank Tiano admire Frank's 1/5-scale KI-61 Tony while taking a moment to relax in the Gold Coast sun.

There's no greater positive force for the case of R/C aeromodeling than a publicly attended R/C scale meet such as Top Gun. The "wow-factor" kicks into high gear, and the crowd can't help but warm up to the colorful scale models depicting highly recognizable designs they've seen in movies such as "Tora! Tora! Tora!" or the series "Baa Baa Black Sheep." The appeal is inescapable. The more who are bitten by the R/C bug, the greater the acceptance of of our hobby, and the clout of our "lobby," if you will, on both the local and national political arenas.

Frank Tiano must be commended for once again conducting the Top Gun event with unprecedented professionalism that makes us here at Air Age Publishing truly proud to be listed with Pacer Technologies as one of the two primary sponsors. Editor Tom Atwood is also to be noted for going the extra mile in working with Frank on coordination and spending relentless hours interviewing so many talented designers, builders and fliers to bring you, the readers, the most complete coverage possible of such a well-attended affair.

Rest assured, it's *Model Airplane News's* intent to investigate how it can help the long-term future of aeromodeling, by whatever means, to spread the word in positive, healthy and inviting way to a public that's often far too skeptical, but we also need your support and ideas. Never hesitate to contact me or Tom Atwood with a suggestion that would serve this end; our ears and eyes are open.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1992. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to:
Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

12-POUND KITTEN

Vic Atkinson of Ontario, Canada, built this Dart Kitten from *Model Airplane News* plans. The Kitten is powered by a Saito .80 with an electronic ignition. Vic says that the 12.5-pound Kitten was a worthwhile project and that it flies very realistically, especially during takeoffs when you see the way that the "sprung" undercarriage functions when the model is about to become airborne. Vic highly recommends the electronic ignition; it starts the engine easily, works reliably and causes no radio interference.

COLE'S PLANE IN 1/4 SCALE

Vern Nulk of Narragansett, RI, spent three years building this 1/4-scale, 23.7-pound Albatross D. Va. It's modeled after the full-scale Albatross replica that belongs to Cole Palen of Rhinebeck Aerodrome fame. According to Vern, the construction is scale inside and out. That includes an interior with Steward Warner gauges and the 6V Ray-O-Vac dry cells with which Palen's airplane is equipped. The enormously accommodating crew at Rhinebeck helped Vern to acquire photos and other information that he used to build the model.

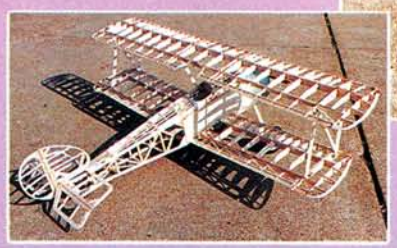
BLUE RAVEN

From Muncie, IN, this is John Zgunda's 1/4-scale version of the Fokker Dr 1 that was flown by Lt. von Raben; *Rabe* is "raven" in German, hence, the emblem on the plane. John built this triplane from a Flair kit, and he says that, with the O.S. 1.20 Surpass swinging an 18x6 prop, its flight performance is as close to scale as you could imagine. Although the slightly elongated nose isn't true to scale, John says that it enables the plane to "fly just like a big trainer."

PILOT PROJECTS

RETURN OF VIDSTICK

Technical Sgt. Revell Walker's video-camera-carrying VH-2 Vidstick replaces his VH-1, which appeared in this space in September 1991. The Sony TR 55 camera is mounted under the engine nacelle, so it can record a panoramic view without the nose or the prop arc getting in the way. "It's designed to see more ground and less sky," says Revell, who is stationed at the Yokota Air Force Base in Japan. "Now I do some serious spying!" Shown in the photo are Yurika and Miyuki.



MONTANA CAMEL

Bud Gewinner of St. Louis, MO, built this 1/7-scale Sopwith Camel from a three-view he obtained at the library. The 46-inch-span fighter weighs 3 pounds, 6 ounces without fuel. Bud drives an English sports car, so this model can be broken down in an unusual way. The top wing, cabanes and tail feathers can be separated from the fuselage by removing one bolt, and the fuselage itself can be disassembled aft of the wing saddle. The interplane struts just snap into music-wire clips that are fastened to the wings.

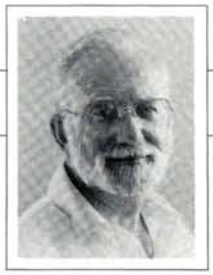
MOTH IN THE LIGHT

Wally Kranz of Muncie, IN, scratch-built this striking 1/4-scale deHavilland 82 A Tiger Moth—and did a beautiful job of photographing it, too! The 23-pound Moth has an 88-inch wingspan, and it's powered by a Zenoah .38. Wally painted it with red Krylon, and he finished the wings by dissolving aluminum powder in clear nitrate dope and then painting the wings with this solution. Wally characterizes its flight as "excellent," and he has logged 24 flights to prove it!

GARY'S "ENDEAVOR"

Gary Parlato of Paducah, KY, ordered plans of the Space Shuttle Endeavor, but he was so impatient that he built the model from drawings before the full-size plans arrived. He enlarged the design by 50 percent, to boot! The 65-inch-span model weighs 13.5 pounds and has a 2-inch-travel landing-gear system; its "shocks" are hypodermic needle cylinders that are filled with oil and air. Gary's Endeavor hasn't yet been flown.

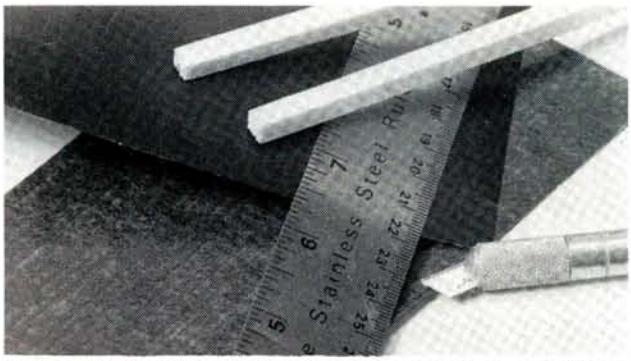
How To:



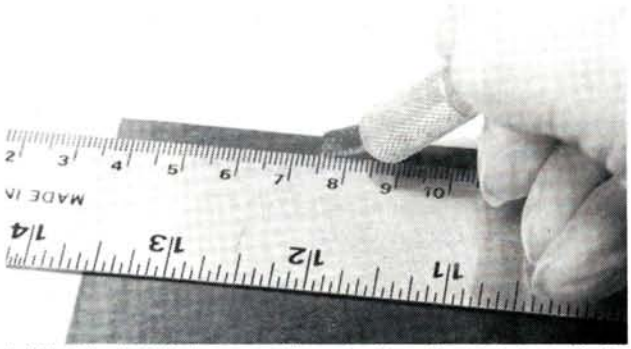
RANDY RANDOLPH

MAKE CARBON-FIBER LAMINATED SPARS

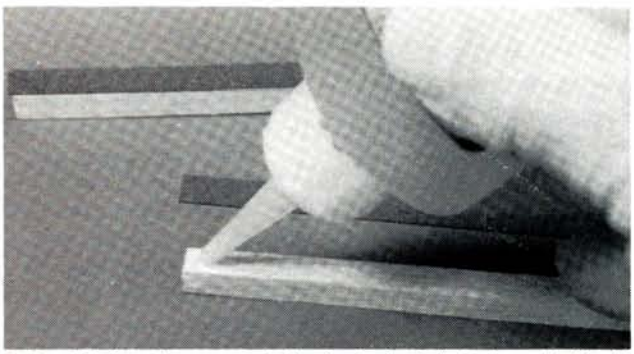
Made by mixing carbon fibers with epoxy resins, carbon-fiber laminate is versatile, strong and light—perfect for strengthening wing spars. Manufacturers such as Aerospace Composite Products and Bradley Model Products* offer it in 3- or 4-inch-wide 3-foot rolls. The photos show you how to apply laminate to your wing spars as you build, so that you can use smaller, lighter—yet stronger—spars than those called for on the plans.*



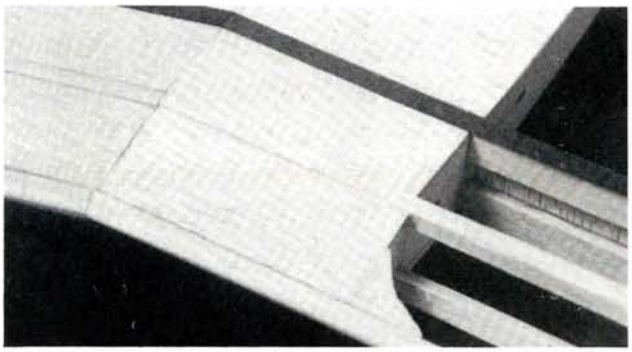
1. In addition to the laminate, you'll need spar stock, a metal straightedge, an X-Acto knife with a very sharp blade and slow-curing CA. Note that both sides of this 0.007-inch-thick carbon-fiber laminate are shown; one side is smooth, and the other has a rough grain.



2. Using the straightedge as a guide, cut a piece of laminate (smooth side facing upward) that's as wide as the spar. Press hard on the straightedge so that it won't slip.



3. Run CA along the spar, and glue the laminate into place. Position it with the rough side facing downward; it will stick to the spar better.



4. When you assemble the wing, the laminated side of the top spar should face upward and that of the bottom spar should face downward.

5. You can also use laminate to strengthen planes that you've already built. In addition to spars, you can put it along wing trailing edges to reinforce dihedral joints and prevent the edges from being damaged by the hold-down rubber bands.

Here are the addresses of the companies mentioned in this article:* ***Aerospace Composite Products,* *P.O. Box 16621, Irvine, CA 92714;* ***Bradley Model Products,*** *1337 Pine Sap Ct., Orlando, FL 32825.*

HOW TO

Trim Sailplanes for Aerobatics

For more precise maneuvers

by JEF RASKIN

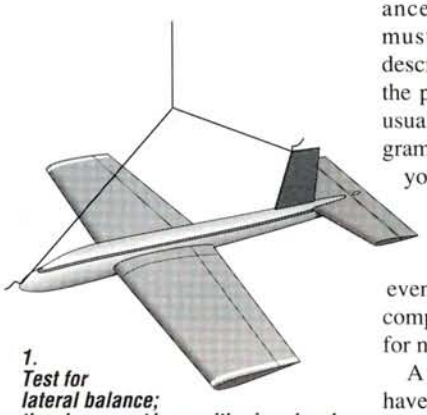
IT CAN BE difficult to trim a model sailplane for aerobatics. For example, if a plane never finishes a loop in the direction from which it started, this can be the result of bad aileron trim or rudder trim—assuming that you're flying the plane correctly. The two effects can look the same. This article explains how to tell what bugs have gotten into your plane, how to tell similar effects apart, and how to fix them. A lot of these techniques are the same or similar to those used to set up aerobatic power planes; in fact, we have a simpler task, since there's no torque from the spinning propeller and no spiraling slipstream to complicate the way our planes fly.

What we want to achieve is an ideal aerobatic sailplane. It should have the same response upside-down (inverted) and right-side up, which means that it can maneuver equally well and with the same control inputs in either orientation. A well-trimmed sailplane should track easily through inside and outside loops without rolling to right or left, and it should come out on the same heading as when it started. Applying rudder should yaw the plane sideways without causing to roll, climb, or dive.

To test your airplane, you'll have to be able to fly upright and inverted and do inside and outside loops. Rudder, elevator and aileron control are assumed, although some of these tests apply to 2-channel planes. The case where there are flaps (usually coupled to the elevator) is also considered.

BENCH TESTING

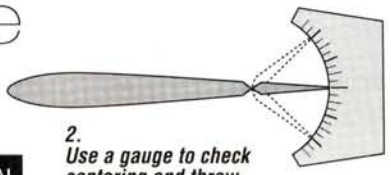
Trimming starts on the building board. The first thing to check is whether one wing is heavier than the other. How you test this depends on the plan: with some fuselages, you can put a pin in the tip of the nose and another in the end of the tail cone. Tie two threads to these pins and suspend the airplane from the threads. The heavier wing will, of course, rotate to the bottom. You can correct the condition by putting weights in the wing tip of the lighter wing.



1. Test for lateral balance; the plane must hang with wings level.

Flight testing can distinguish incorrect aileron trim from either wing-heaviness or incorrect rudder trim, but it can't diagnose both at once. This is why we must correct any wing heaviness (which, unlike the other problems, can be detected in the shop) before we start flight testing.

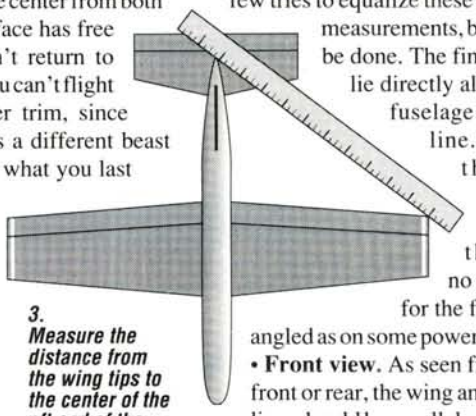
It's essential that all control surfaces have no free play. They must center to their neutral position precisely. Don't simply eyeball this, but check with a ruler or other guide to see that all surfaces return precisely to the center from both sides. If a surface has free play or doesn't return to center, then you can't flight test for proper trim, since the airplane is a different beast depending on what you last did! You can't fly precision aerobatics unless you have a model built with precision.



2. Use a gauge to check centering and throw.

The balance point must be as described in the plans or as calculated by the usual formulas. When using a program (such as MaxSoar) that gives you a range of balance locations, you'll find that it's best to choose the rearmost point of the specified range, or even a bit behind it, since most computer programs are designed for non-aerobatic flight.

A fully aerobatic plane shouldn't have differential ailerons because the differential would work against you in inverted flight or outside maneuvers. The ailerons should have no warps and move equal amounts up and down on both wings. Use a ruler or a homemade gauge. It's also important to seal the gaps between surface and control: unequal gaps can act like warped wings. The same goes for all controls. The control motion should never be more than 30 degrees each side of center.



3. Measure the distance from the wing tips to the center of the aft end of the fuselage. The tips must be equidistant from that point.

• **Side view.** If the plane has a symmetrical airfoil, set the ailerons and elevator to neutral and check that the wing incidence and stabilizer incidence are both zero. I use an incidence gauge or measure from a flat surface. If your plane doesn't have a symmetrical airfoil, it's difficult to make it behave the same inverted as upright.

• **Top view.** Viewed from above, the wing and stabilizer must be perpendicular to the fuselage center line. In this regard, my planes are square within 1/32 inch at the wing tips. I make sure the wing is centered and then check the distance from a corner of the wing tips (or some other easy-to-measure-from point) to the center of the fuselage at the rear. It takes a few tries to equalize these pairs of measurements, but it can be done. The fin should lie directly along the fuselage center line. Since there's no propeller, there's no reason for the fin to be angled as on some power planes.

• **Front view.** As seen from the front or rear, the wing and stabilizer should be parallel and horizontal. If there's any dihedral, it must be equal on both sides: most precision aerobatic sailplanes have no dihedral in the wing or stabilizer. The fin should be vertical and centered.

• **Control surfaces.** There must not be any free play; all gaps must be sealed; the surfaces must return perfectly to center from both sides, and they must have no more than 30 degrees of throw each side of neutral.

Summary. *If the plane isn't built right and tight, it won't do well in flight. All the rest of these*

tests will be useless if the plane isn't true and square.

TEST FLYING

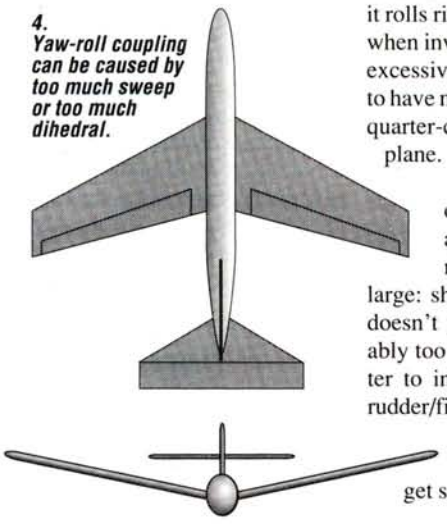
The tests outlined here are given in a certain order. To detect the "culprit" in a plane that won't fly right, we have to examine our clues one at a time. Only after we've eliminated certain problems can we begin to diagnose others. Unfortunately, pilot error can mask some of the effects we're looking for (for example, you might be unknowingly adding a little aileron whenever you use the elevator), so do each test a number of times and, if you can, with more than one pilot.

THE HANDS-OFF TEST

To repeat: if, and only if, the plane has been built accurately will flight testing clearly reveal any further problems. The first test is to put the craft into straight and level flight. A good aerobatic plane is surprisingly stable and can fly for at least five seconds hands-off without any noticeable roll, pitch, or yaw in smooth air. If you can't trim it so that this is the case, then it was poorly designed, built crooked, has loose controls, or is tail-heavy.

DISTINGUISHING BETWEEN THE EFFECTS OF DIHEDRAL AND SWEEPBACK

Both excessive dihedral and excessive sweep will cause the plane to roll when you apply rudder. If your plane has no sweepback (as measured at the quarter-chord line, not at the leading edge) then you only have dihedral to worry about.



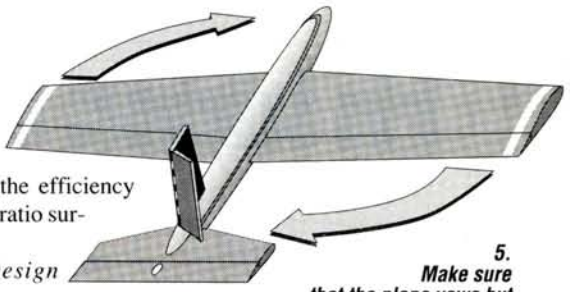
4. Yaw-roll coupling can be caused by too much sweep or too much dihedral.

To avoid problems caused by excessive sweepback, I build my planes with less than 10 degrees of sweep to avoid any problems from this cause. Here's how you find out if you have a problem:

Fly upright straight and level. Apply rudder. The plane should yaw without dropping a wing. If the plane rolls right with right rudder, there's too much dihedral or sweepback; if it rolls left with right rudder, then more dihedral or sweepback is needed. A high wing acts like dihedral.

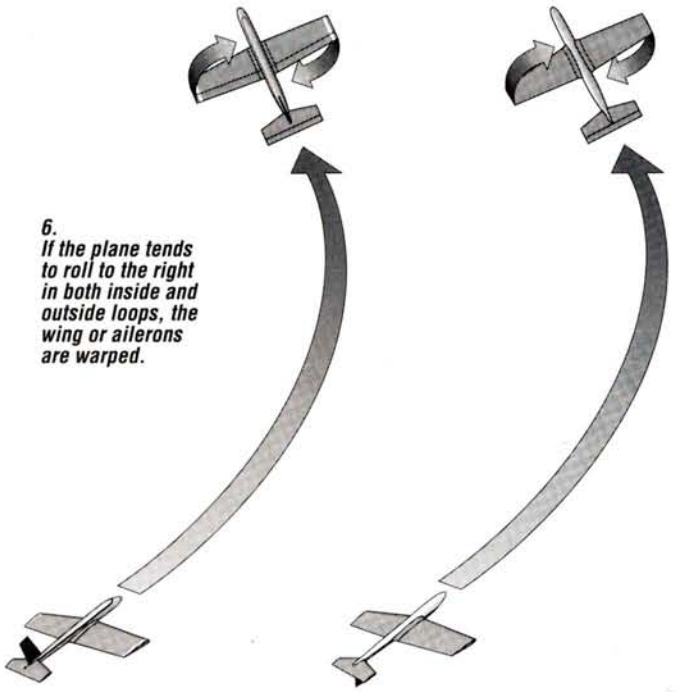
To tell which is which, fly inverted straight and level. Apply right rudder. If the plane rolls right both upright and inverted the effect is due to too much dihedral. If it rolls right when upright and left when inverted, the effect is due to excessive sweep. It's a good idea to have no sweep (measured at the quarter-chord line) in an aerobatic plane.

If the plane pitches up or down when rudder is applied, then the fin and rudder are probably too large: shorten them. If the plane doesn't yaw, the rudder is probably too small. It's generally better to increase the chord of the rudder/fin assembly than its height, since if the fin and rudder are too tall, you'll get some yaw in your aileron-only rolls. This is opposite the advice for thermal sailplanes where the efficiency of a higher aspect ratio surface is desirable.



5. Make sure that the plane yaws but doesn't roll with rudder input.

Summary. *Design with no or little sweep. Then if right rudder rolls the plane right in upright flight, you'll know that there's too much dihedral; if right rudder rolls the plane left, there's too little dihedral.*



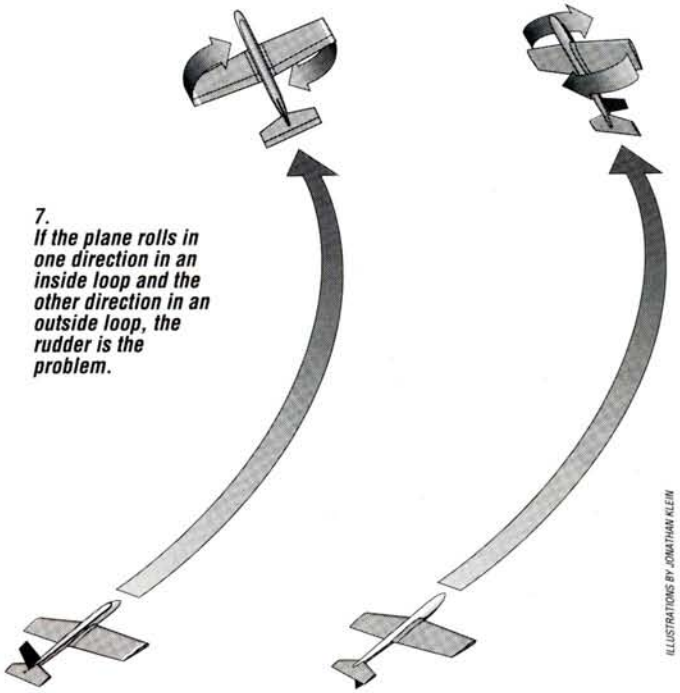
6. If the plane tends to roll to the right in both inside and outside loops, the wing or ailerons are warped.

SEPARATING RUDDER AND AILERON EFFECTS

Both out-of-trim ailerons (or warped wings) and an out-of-trim rudder or fin can cause rolling when you apply the elevator. Here's how to tell them apart. From dead-level flight (perhaps after a dive to pick up speed) into the wind, do an inside loop upward. Do this a few times. It should loop without requiring aileron or rudder input. Note if it rolls one way or the other.

Say it rolls slightly to the right. This could be due to having one wing heavier than the other, to the ailerons being out of trim, or to the rudder or fin not being centered. The wing heaviness can be (and should have been) fixed on the bench. Technically, even if the wing is static balanced when you test it in the shop, an uneven distribution of the weight can still couple pitch to roll, but for any reasonably well-built wing, this effect will be too slight to notice.

If the plane rolls while you're



7. If the plane rolls in one direction in an inside loop and the other direction in an outside loop, the rudder is the problem.

ILLUSTRATIONS BY JONATHAN KLEIN

Trim Sailplanes for Aerobatics

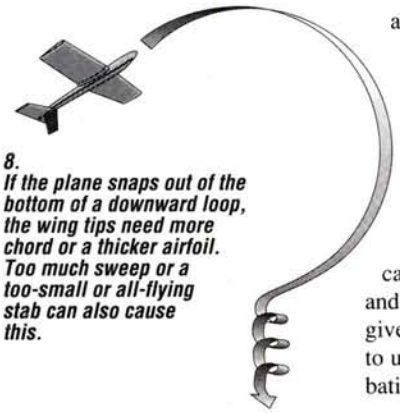
doing an inside loop, try flying the plane inverted and do an outside loop upward (just as you did the inside loop upward). If the plane still rolls to the right, then the problem is a warped wing or incorrect aileron trim. This effect can also signal a warped stabilizer.

If, however, the plane always rolls to the left in an outside loop and rolls to the right in an inside loop, there's some right trim to the rudder (assuming the wings are balanced).

Summary. *If inside and outside loops make a plane roll in opposite directions, the problem is rudder trim; if it rolls in the same direction, the problem is aileron trim.*

DISTINGUISHING WING WARP FROM AILERON TRIM

When flying at a constant speed, you can trim out the effects of wing warp with the ailerons. However, as your speed changes, the amount of aileron needed will also change, making the plane difficult to fly with precision. To test for this, trim the elevator for slow, hands-off flight; as slow as your plane can go without stalling. Then, using elevator only, gradually dive the airplane until it's pointed straight down. (I have a suspicion that it's best to start this test pretty high up.) If it rolls on the way down, you have a warped wing or, what's less likely, a warped stabilizer. A flexible plane can also cause problems—aerobatic models must be stiff! Misalignment of the fin or rudder can also cause a roll when diving, so you'll have to make sure that the fin and rudder pass their tests first.



8.
If the plane snaps out of the bottom of a downward loop, the wing tips need more chord or a thicker airfoil. Too much sweep or a too-small or all-flying stab can also cause this.

ARE YOUR WING TIPS TOO THIN OR NARROW?

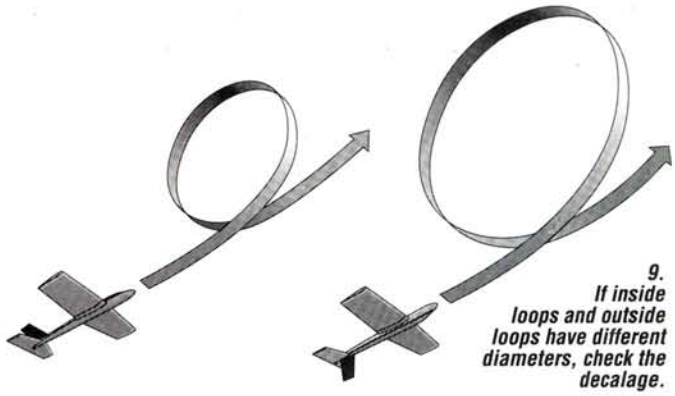
Some aerobatic models have the nasty habit of snapping out at the bottom of a downward loop. This can be caused by a stab that's too small, but inadvertent snapping is more often caused by tip stalling due to incorrect wing design, e.g., the wing tips may be too thin. Alternatively, the tips may have too little chord. The tip chord should not be less than half the root chord on an aerobatic model.

Excessive sweep is another cause of premature tip stalling, but if you have no roll with rudder as mentioned above, then the sweep probably isn't your problem. On some models, I've cured tip stalling by limiting elevator travel, but a well-designed plane won't exhibit this problem under any conditions.

A last cause of inadvertent snaps is the use of an all-flying stabilizer. A conventional stabilizer with movable elevator is less prone to stalling. This is because it's a cambered surface and can achieve more force for a given area. It's generally best not to use all-flying surfaces in aerobatic models.

WHERE SHOULD THE PLANE BALANCE ?

This is a matter of taste, unlike, say, yaw-to-roll coupling which is always undesirable for aerobatics. If the plane won't fly hands-off unless you add some nose weight, then it's tail-heavy, as I mentioned above, but how can you tell if you've added too much weight? Trim for normal upright flight and then roll inverted. The plane should require only a tiny amount of down, well within the usual trim-control range, to fly level inverted. If it requires more than this, it's too nose-heavy. My best planes will fly either upright or inverted without trim change; none requires more than one or two clicks of the trim lever.



9.
If inside loops and outside loops have different diameters, check the decalage.

DECALAGE

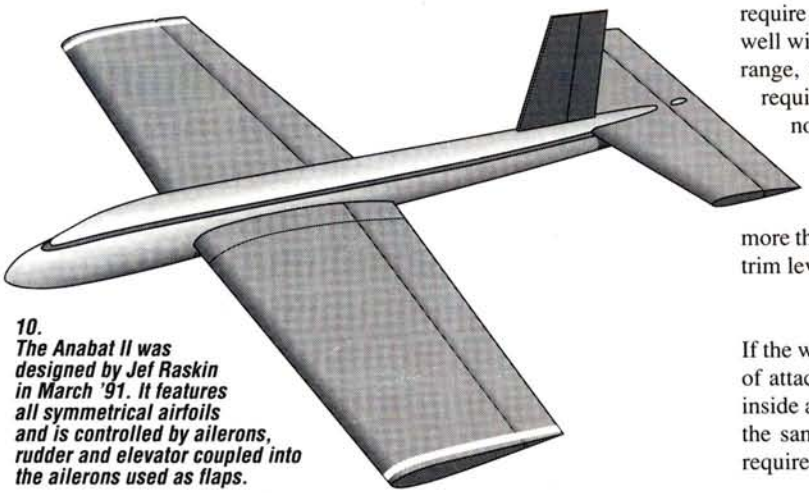
If the wing has more or less angle of attack than the stabilizer, then inside and outside loops won't be the same diameter, and one will require more control input than the other. A more precise test, however, is to fly the plane upright and inverted in slow passes in front of you. Observe the elevator deflection; it should be in the same amount but in opposite directions on the two passes. If there's too much angle of attack, there will be more elevator deflection when flying inverted; if there's too little, there will be more elevator deflection when flying upright. There's too much to think about when flying aerobatics to have to worry about different amounts of elevator input just because you're inverted.

FLAPS

It's getting more common to couple flaps or flap-ailerons (flaperons) to the elevator (as with many control-line stunters). The flaps go in the opposite direction from the elevator, although they don't move through nearly as large an angle. This makes loops tighter, makes the plane more efficient, and allows the use of thinner airfoils. If you can uncouple the flaps from the elevator, first make sure that the plane is trimmed correctly without them. Then run the same tests with the flaps operational. Any problems introduced will then be due to the flaps, and you can diagnose them as aileron or decalage errors.

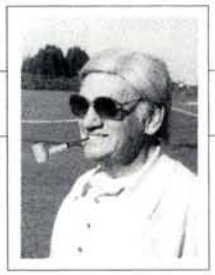
SUMMARY

Following this outline will help get you a sailplane that can do precision aerobatics. Flying the maneuvers is now up to you.



10.
The Anabat II was designed by Jef Raskin in March '91. It features all symmetrical airfoils and is controlled by ailerons, rudder and elevator coupled into the ailerons used as flaps.

GOLDEN AGE OF R/C



HAL DeBOLT

MORE ABOUT BRANSTNER

Pat Clark of Bison, SD, readies his 40-year-old "ghost" LW Champ at a fun fly last August in North Dakota. (Note the "summer" apparel!)

RESPONSE TO the column in which I told the story of Dick Branstner has been amazing. All agree that he was a visionary, but few knew the full extent of his activities. Some of those who wrote to me knew him, and I was pleased to receive a fine letter from Mary Branstner, who reminds us that Dick died in '84, not in '85, and that, as well as two sons, they have two daughters, Amy and Stacy, who are also very proud of his achievements.

Mary says that, after leaving the R/C world in 1965, Dick designed the first "pickle-fork" hydroplane—"Miss Smirnoff"—and he also developed a fuel-injection system for its Allison engine, which usually had a carburetor. After that, he moved into research and development for the Lionel and Tyco Corps., where he was responsible for many inventions and patents. He was remarkably busy and very productive. Our friend Dick Branstner was a one of a kind.

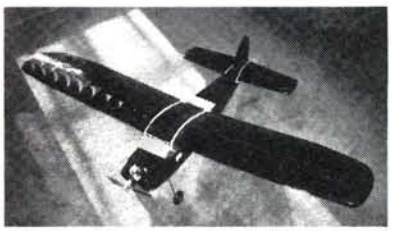
READERS SAY...

Speed Hughes of Yuba City, CA, called to tell about his friend's "moving" experience. When exploring the attic of his new home, he was more than happy to find a dust-covered Hollinger PT-19 that was equipped with a Bramco radio and Bonner servos. Being a SAM type, Speed couldn't resist the temptation to dust it off and get it flying again—with the *original* radio. With its 9-foot antenna, the Bramco, ground-based transmitter was intimidating, but Speed found that his World Engines hand-held reed transmitter was an acceptable substitute. To the amazement of the modern types who have seen it, the reed-controlled PT-19 flies well—on the 27MHz band! Speed says he can hear the CBers talking through the reeds in the model, but when the transmitter is turned on, it blocks them out satisfactorily. I've heard stories from others along the same line. Big John Elliott of Cox Hobbies says a current, simple, Cox radio operates on 27MHz without any problems. Are these experiences enough to encourage you try OT equipment that you stowed away because you feared CB interference?

Myron Cary with his 27-year-old LW Cruiser. It originally had single-channel escapements and .19 power, but it has progressed to a modern Futaba radio and an Enya .40.

Do you remember the column in which I wrote about the OQ-2 drone? I didn't know who had sent me the OQ-2 manual, but Richard Smith of Fredericksburg, VA, has checked in to say he was the Good Samaritan. He saw similar drones launched by catapult and recovered by parachute outside Wichita, KS, in the late '40s. Does that ring any bells?

Richard also recently became the fourth (or more) owner of a Ken-Hi "Buzzer'd" OT R/C that he'd like to refurbish and fly.



Lew Hiebert's Aero 9 replica—a John Zaic design that was kitted in the '50s.

To do this, he'd like to beg, borrow, or steal some Buzzer'd drawings. Can anyone help? He also needs advice on how to remove the Buzzer'd's doped-on covering—preferably, quickly and neatly. Does anyone have any ideas? (Write to: Richard Smith, 19 Lord Fairfax Dr., Fredericksburg, VA 22405.) How about Ken-Hi? Does anyone have information about that California company?

Harvey Braunlich of Victor, NY, says the Senior Pattern Association sounds great to him. He'll build his third Live Wire (LW) Sonic Cruiser for the novice pattern schedule, and he'll need a Dmeco bottom-mounted nose gear for it. Can anyone help with that? He also asks which LW designs would be suitable for the SPA "super" pattern schedule. I can help with that: all those that can be powered by a .40, e.g., Cobra, P-51, Viscount, P-Shooter and Acrobat.

Lew Hiebert says he has at last found

(Continued on page 30)

(Continued from page 28)

plans for his first R/C plane—the Aero 9, which was designed and "kitted" by John Zaic. He has made a replica, and it's ready for flight. His original flew with a Fox .09 and a radio, which like others at the time, had a rather limited range. The replica should do well with a Cox .09 and a single-channel Cox radio using a miniservo. Weighing only 2 pounds, it should fly up a storm.

A nice note from Myron Cary of Endwell, NY, of the Aero Guidance Society, contained a photo of his fourth R/C plane, which he built in 1965. Originally controlled with escapements, and then with pulse and Mighty Midget motors, the Cruiser now flies with a Futaba radio and an Enya .40 powerplant. Twenty-seven years old and still going! (The plane, not Myron!)

IN PURSUIT...

Robert Harvey of Marcelona, MI, writes that in 1965, his 11-year-old-son bought a LW Pursuit kit with his paper-route money. Dad obviously did 95 percent of the construction, but they worked on it together. As you've probably guessed, the youngster grew up and left the nest before he had saved enough for a radio. Harvey Sr. retired and started modeling again. He stripped the enamel-painted silk off the Pursuit, covered it with MonoKote and then installed a modern radio and an O.S. .48 4-stroke. It now has 11 flights on it. He wonders why I've never discussed the Pursuit. I will—next time!

Active R/Cer Art May of Bismark, ND, reports on his club's August fun fly. (Did he say *August?* Check the winter gear in the photo!) He writes that Pat Clark of Bison, SD, joined the fun with his LW Champ—now equipped with modern gear. The point is that the Champ was built in the '50s and recently resurrected. It must be that old R/Cs never die; they just fade into our attics!

I hope you can see that this is your OT R/C place. Do check in.

TOP GUN INVITATIONAL

MODEL AIRPLANE NEWS AND

Left: as usual, the crowds were mesmerized by this, the grandest of all scale competitions.

Below left: tents on the flight line shelter scale masterpieces (and their builders) from the West Palm Beach sun. Left: an enormous crowd gathered for the flight competition!

Below: Top Gun winners pose after the award ceremony. Frank Tiano, on his knees at center, was quite moved by the moment.

by TOM ATWOOD

THOUSANDS OF model aviation buffs bent on having a good time flocked to sunny West Palm Beach, FL, this year to witness the fourth annual Top Gun Invitational. It was held on May 7 to 10 on the expansive, well-kept, putting-green-like grounds of the West Palm Beach Polo Club. *Model Airplane News* and Pacer Technology again co-sponsored the scale meet, which many now regard as the pinnacle of scale competition. A raft of contributing sponsors donated prizes and prize money as well, which only boosted the excitement of this highly competitive, and often dramatic, event.

Top-level, invitation-only scale modelers from across the country and, indeed the world, competed for thousands of dollars in prizes in Expert and Team Scale classes. No less than 53 models were campaigned, and many more were exhibited on the flight line and in demo flights. A walk down the flight line revealed the finest examples of model engineering and scale artistry. I can only say that if you're a modeler at heart and you attend a Top Gun, the inspiration to venture into serious scale building (or to do so again) is nearly inescapable.

Frank Tiano, the Top Gun King, checks out his KI-61 Tony before morning flight practice. The scalemeister scratch-built the plane from his own plans. WS—91 inches; WT—20 pounds; E—ST 2500, C&H spark ignition; P—Zinger 16x6.

Above: this beautiful P-51D was scratch-built of balsa and ply from Dave Platt plans by father-and-son team Jim and Maury Maroney. It's clad in 1/5000-inch-thick aluminum (compound-curve areas are covered with aluminum-backed duct tape). Inset: note the amazing finish on the fully sheeted, glassed, aluminum-clad, built-up wings. WS—81 inches; WT—24.5 pounds; E—ST 2500; P—Zinger 18x8.

We extend our congratulations to all of the winners, and particularly to Charles Nelson, who took 1st place in Expert with his Waco (built from Paul Matt plans) and to Dean DiGiorgio and Bob Pickney, who took 1st in

(Text continued on page 39)

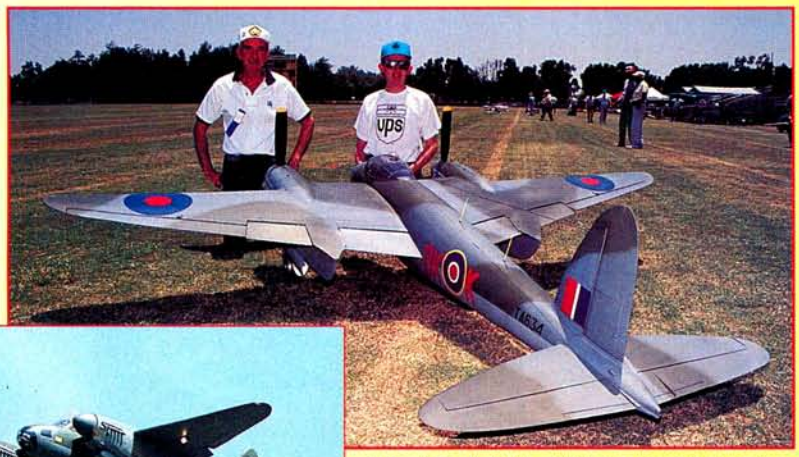
CAPTION KEY
WS: wingspan
WT: weight
E: engine
P: prop

ACER TECHNOLOGY PRESENT

Jim Wilkinson scratch-built this 1/6-scale JU87-B Stuka. The plane was lost early on during flight practice. WS—91 inches; WT—20 pounds; E—ST 2500, C&H spark ignition; P—Zinger 16x6.

Charlie Nelson, 1st-place winner in Expert Class, basks in the glory of coming out on top at Top Gun. See page 36 for stats on his winning Waco.

Left: Art Johnson's scratch-built, aluminum-clad P-35A is an eye-catcher at any scale event. WS—86 inches; WT—22 pounds; E—O.S. 3500; P—Zinger 18x10.



Richard Rawle (pilot and designer) and Peter Guiver (builder) brought this scratch-built, 1/5-scale deHavilland 98 Mosquito all the way from Great Britain, thanks to the UPS sponsorship (UPS also transported the other British contestants and planes.) It's covered with doped Japanese tissue that has a final coat of two-part epoxy lacquer. WS—120 inches; WT—50 pounds; E—Zenoah G-38s; P—19x10.

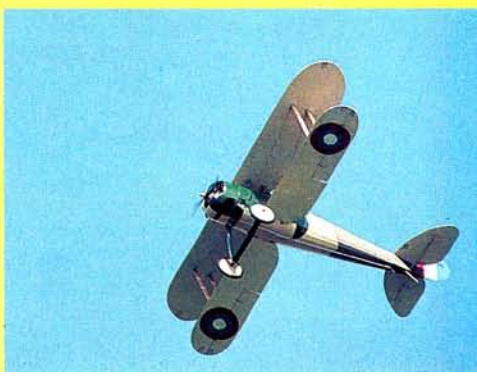
The KI-100 charges into the air. Lee Rice scratch-built the 1/5.5-scale aircraft. WS—86 inches; WT—17.5 pounds; E—ST 2500; P—Zinger 16x6.

Bill McCallie's P-47D includes in-flight control of fuel mixture, flaps, fuel-tank drop, a gear door and retracts. Retracts are operated by a sail-winch servo connected to a Gene Barton gear mechanism, for slow, scale-like retraction without the need to pump air. WS—81 inches; WT—23.5 pounds; E—Webra Bully; P—Zinger 18x8.

Wayne Siewert's Porsche Mooney featured amazing detail. Note the custom-molded glass panels on the tailplane. WS—88 inches; WT—16 pounds; E—O.S. 1.08; P—Graupner 3-blade 14x6.

Bill Carper shows off his beautiful 1/6-scale P-47D. Built from a Baker kit (now carried by Yellow Aircraft), the plane is covered with aluminum tape. Available from Cleveland Specialty, the tape comes in 6-inch-wide, 60-yard rolls. WS—80 inches; WT—24 pounds; E—ST 3000; P—18x6.

Below: George Buso placed 7th in Expert with this Nieuport 28 built from Proctor plans. WS—84 inches; WT—15 pounds; E—Enya R-120; P—16x8.



PHOTOS BY TOM ATWOOD & YAMIL SUED

TOP GUN

Even from the bottom, there's no doubt it's a Spacewalker. Bruce Tharpe scratch-built this 1/3-scale beauty. WS—104 inches; WT—21 pounds; E—ST 3000; P—18x10.

Chuck Fuller's "Daring Damsels of the Sky" Super Stearman majestically gushes smoke. Each wing has two, full-length, Douglas-fir spars. WS—98 inches; WT—37 pounds; E—Sachs 5.8; P—Zinger 22x12.

This Yellow Aircraft Spitfire XIV built by David Voglund is modeled after a restored airplane owned by Rolls Royce Ltd. It carries 4.5 pounds of no. 12 birdshot to "get the tail down"! WS—88 inches; WT—25 pounds; E—O.S. 3500; P—Zinger 18x6/10.

Marc Levy of Paris, France, scratch-built this gorgeous Sirius TR-325, which sports the same type of paint that was used on the original plane. The plane has a fiberglass fuselage and foam wings covered with balsa and Japanese tissue. WS: 82 inches; WT: 22 pounds; E: Zenoah G-62; P: Menz 22x12.

Frank Thomas's 1/5-scale, clipped-wing Spitfire Mk XIVE is covered with 3/4-ounce fiberglass that has been impregnated with four coats of clear paint rather than resin (sanded each time) to save weight. WS—88 inches clipped to 80 inches; WT—21 pounds; E—ST 2500; P—World Engines 16x8.

This graceful 1/4-scale Rearwin Skyranger, scratch-built by Eduardo Esteves of Brazil, was a testament to honest modeling. Eduardo machined the hardware himself. The fuselage is covered with nylon, and the wings with Sig Coverall painted with automotive enamel. WS—109 inches; WT—26 pounds; E—O.S. Gemini twin; P—20x10.

Top: Mike Booth's scratch-built Hawker Fury biplane sparkled in the Florida sun on the ground and in the air. Above: Mike is working on his plane in preparation for flying competition. WT—22 pounds; E—Zenoah G-38; P—22x8.

Ed Newman shows stitching detail on underside of the Storch's fuselage. Above: the 1/5-scale Storch is an all-balsa-and-ply airplane adapted from enlarged Svenson plans. WS—114 inches; WT—22 pounds; E—O.S. 1.08; P—Zinger 16x6/10.

David Toyer—one of the British contingent sponsored by UPS—brought this 1/6-scale Trent Meteor. Scratch-built from Boddington plans, it's made of balsa and ply, with fiberglass nacelles and outer foam-wing panels. WS—76 inches; WT—18 pounds; E—ST .40s; P—Graupner 10x6.

David Hayes was seen spraying the grounds with "insect repellent" (fire-extinguisher powder and oats) with his scratch-built, 1/7-scale Rockwell Thrush, which took 9th in Expert. WS—78 inches; WT—14 pounds; E—O.S. .91 4-stroke; P—Zinger 15x6.

Bud Roane scratch-built this high-flying, 1/4-scale Thomas Morse Scout. WS—80 inches; WT—22 pounds; E—Quadra 35; P—18x8.

Mel Whitley is a modeler we could all learn from. Last year, he took 1st in Expert, and this year, he took 2nd! No, it's not the plane he campaigned last year. This is a model of the original (last year's entry was a model of a full-scale replica). WS—80.5 inches; WT—26 pounds; E—O.S. 300 twin; P—Zinger 20x6/10.

This 1/6-scale Skyraider gets well-deserved attention at any scale meet. Diego Lopez took 3rd in Expert. WS—90 inches; WT—36 pounds; E—Webra Bully; P—Zinger 18x8.

Bob Underwood, AMA technical director, scratch-built this Stormavik low-attack plane. WS—81 inches; WT—18.5 pounds; E—O.S. 1.08; P—Zinger 15x6.

Corvin Miller's scratch-built, 1/4-scale Globe Swift won Best Civilian last year and 10th in Expert. This year, it was Best Civilian and 6th! WS—80 inches; WT—21 pounds; E—O.S. 1.60 twin; P—Zinger 16x6/10.

Hal Parenti's Fireball had both jet and tractor-prop propulsion. A failed elevator servo during takeoff removed it from competition in the later rounds. How many rivets?—31,000. WS—72 inches; WT—17 pounds; E—ST .75 tractor and O.S. .46; P—TF 13x8 and Kress Jets fan.

Kim Foster's Curtiss Jenny, built from a Proctor kit, sported closed-loop cable controls just like the original. It took Kim approximately 700 hours to build this plane. WS—88 inches; WT—9 pounds; E—Laser 75; P—Zinger 13x7.

The 1/8-scale C-47 built and flown by Ron Chizek and Gerry Garing ends its last flight after one engine failed (it fell several hundred yards from the buildings). Earlier, Ron and Gerry assemble the giant model for competition. WS—144 inches; WT—44 pounds; E—Quadra 35s; P—Zinger 18x8s.

David and Tony Malchione teamed up on this Bob Violett kit T-33. The canopy close up looks almost eerie in its scale-like appearance. The plane was an exciting sight in the air and on the ground, and it took 7th in Team Scale. WS—80 inches; WT—15.5 pounds; E—BVM .91; P—Viojett fan.

TOP GUN

Charlie Nelson's 1st-place winner—a scratch-built 1/5.3-scale Waco VKS7F shown on a landing approach. Designed from Paul Matt plans, the balsa, plywood and fiberglass model has aluminum fairings at the wing roots and vertical stab. The plane is a scale replica of the last standard-cabin Waco produced, and it includes retractable landing lights and onboard fuel-mixture control. Fiberglass corrugated ailerons were cast in moldings. Impressive! WS—76.4 inches; WT—16 pounds; E—O.S. .91; P—Zinger 16x5.

Is this immortal face not recognized the world over? It is, of course, scale guru Dave Platt. When Platt wasn't announcing, he and Ron Ellis campaigned this im-pressive, well-weathered, 1/5.5-scale zero built from Platt plans. WS—80 inches; WT—19 pounds; E—O.S. 1.08; P—Zinger 14x8.

Note the concentration among the judges as they carefully study scale documentation and Brian O'Meara's Zero, which was built from Platt plans. WS—83 inches; WT—19 pounds; E—ST 2500.

Shailesh Patel, who took the coveted "Top Buns" award, scratch-built this 1/6-scale F4U Corsair from his own plans. WS—82 inches; WT—26 pounds; E—Webra Bully; P—Zinger 18x8.

Bill Harris's BVM F-86 gleams like gold. It took 10th in Expert. WS—58 inches; WT—12.75 pounds; E—BVM .81; P—Viojett fan.

Charlie Chambers built this gorgeous 1/9-scale F-16C using Yellow Aircraft and Bob Violett plans. Note the functional speed break at the tail pipe. WT—13 pounds; E—BVM .82; P—Viojett fan.

Bob Violett and Jerry Caudle took 2nd in Team Scale with this BVM F-16C, and Jerry picked up the Craftsmanship award to boot. Note canopy details. Jerry used shiny paints (all Ditzler) with a final flat coat, which was then scuffed. Aeroloft markings finish this piece of art. WT—13 pounds; E—BVM .91; P—Viojett Fan.

Right: the scale details and compound curves of Bob Fiorenze's 1/7-scale F-18 Hornet are a sight to behold. Above: Bob's Yellow Aircraft F-18 is scrutinized closely in the judging competition. The plane later went down when it lost an engine. WS—72 inches; WT—27 pounds; E—O.S. .91s; P—Dynamax fans.

Above: Dick Hanson built this 1/4-scale Albatross DVA from a Proctor kit. Photo by John Jundt. Left: Detail of Spandau guns. WS—80 inches; WT—23 pounds; E—Enya V-240 with C&H spark ignition; P—Zinger 18x6/10.

Sam Wright (left center, with toy heli) and Dave Platt (right center, in conference with the heli owner) served ably as announcers throughout the competition.

Frankie T., Top Gun kingpin, shows intense concentration during the competition.

The Cloud Dancers' F-15s in striking repose between dazzling exhibition flights.

Terry Nitsch poses with his BVM F86. He ought to smile; he took 4th place in Expert! WT—13 pounds; E—BVM .91; P—Viojett fan.

Bob Fiorenze's Yellow Aircraft F-14 Tomcat was one of several show-stoppers. Functional swing wings pivot through 68 degrees in flight. The drive mechanism is as big as a double-size sail-winch servo. WS—swept (52 inches); extended (88 inches); WT—22 pounds; E—twin O.S. .91s; P—Dynamax.

Built from Platt plans, Jeff Foley's Zero scored an impressive 5th place in Expert. WS—80 inches; WT—18 pounds; E—O.S. 1.08; P—Zinger 14x8.

Patty Generali and Paul Schuessler took 8th in Team Scale with this BVM F-86. Concentration is intense as Patty and Bob Violett prepare the F-86 for flight. WT—13.5 pounds; E—BVM .81; P—Viojett fan.

★ ★ ★

Tom Czick's Jet Model Products F-4 Phantom was a real crowd-pleaser in the air. Because of an elevator pushrod failure, it didn't survive the meet. WS—58 inches; WT—23 pounds; E—O.S. .65; P—Dynamax fan.

Above & left: The Skyblazer F-86 returns to Top Gun; this time, Kent Nogey built it. WT—13.5 pounds; E—BVM .81; P—Viojett fan.

Mark Frankel designed and scratch-built this 1/7-scale glass F4D Skyray, which took the Best Jet award. Kerry Sterner piloted it well at Top Gun, considering that he hadn't flown it before! Look for a construction article on this notable plane in a future issue. WS—58 inches; WT—21 pounds with tanks; E—O.S. .91; P—Dynamax fan.

TOP GUN

Richard Crapp from Great Britain prepares his majestic Antonov AN-2 for competition in a prep room at the Palm Beach Polo Club facility. The plane used a total of 17 servos and 9 channels to control lights, slats, cooling "gills" and flaps, in addition to standard controls. Unfortunately, the AN-2 met its end during the flying competition when transmitter batteries failed. WS—126 inches; WT—40 pounds; E—Zenoah G-62; P—Smart 24x8 scimitar.

This beautiful AT-6, built by Rich Uravitch and flown by Nick Ziroli Jr. won 9th place in Team Scale. The plane carries Robart retracts. No wonder there's a growing interest in AT-6 racing! WS—101 inches; WT—29 pounds; E—Zenoah G-62; P—Zinger 22x10.

This big blue 1/5-scale PBJ-1 (B-25) was shown off by Tom Street and Tom Noser in Team Scale competition. WS—101 inches; WT—35 pounds; E—O.S. Surpass 1.20s with pumps; P—Graupner 12x7 three-blade props.

Gene Barton's 1/5-scale AT-6 is based on Ziroli plans, and it has foam wings covered with 3/32-inch balsa and 2-ounce fiberglass. (See can of Bud in pilot's hand.) WS—100 inches; WT—36 pounds; E—Sachs 4.2; P—Zinger 24x10.

The static judges closely examine Roger Young's C-47. Based on Ziroli plans, the 1/8-scale model represents an ECM aircraft used in Viet Nam. WS—144 inches; WT—46 pounds; E—Enya V-240s; P—Graupner 16x6 three-blade.

Mike Barbee, competing in Team Scale with Geoff Combs, stands with his 1/5-scale BT-13 during static judging. WS—92 inches; WT—18 pounds; E—ST 3,000s; P—Zinger 18x6s.

Dean Digiorgio and Bob Pickney took 1st place in Team Scale with this impressive C-45 Beechcraft built from modified Ziroli plans. The hinged nose cap swings open to reveal an aluminum control panel with radio on/off, retract air-pressure gauge, air jack, charge jack, beacon-light tog-gle and engine kill switch. WS—114 inches; WT—45 pounds; E—Zenoah G-38s, with scale functional exhaust; P—Zinger 20x8s.

This B-25 was campaigned by Nick Ziroli Sr. and Bill Steffes. It took 4th place in Team Scale and is constructed of balsa and lite-ply. Nick gets ready for flight competition. WS—101 inches; WT—35 pounds; E—Zenoah G-23s; P—Zinger 15x10s.

Below: this Turborec T240 turbine jet engine is making R/C history; it flew at Top Gun.

Jack Buchoux shows the Byron F-20 with Turborec T240 turbine jet engine installed.

Team Scale with their C-45 Beechcraft (built from modified Ziroli plans).

ON THE SCENE

For those who haven't visited Top Gun, the contest includes both static judging (Thursday and Friday) and flight judging (Saturday and Sunday). To ensure a lively, entertaining program, rounds of competition are punctuated by exhibition flights and demonstrations. Ample bleachers offer spectators a fantastic view of the action. Well-organized concession stands are nearby.

The meet isn't just a daytime affair for competitors and their team members; cocktail parties and a Saturday night dinner/dance party are part of the agenda. If you can get your hands on one of the limited number of tickets for this function (tickets are sold by FTE), go for it. You'll find that Frank Tiano knows how to bring down the house when given a microphone and a captive crowd of modelers. This year, he repeatedly sent the crowd into stitches.

EXHIBITIONS

The exhibition flights were an R/C aviation show in their own right. They included Jerry Candido's Extra 300 and Ken Curny's Sukhoi, both of which ably demonstrated the fine art of aerobatics. Don Muddiman and Tom Volasek, members of the famous Cloud Dancers F-15 precision flying team, put on an unforgettable performance with these large jets. Don also flew his "Flying Machine" in ways that make most hot-doggers look like tree sloths at the control sticks (a 40-G turn out of a screaming nose dive? We think we saw it...). Bob Violett flew his Viper high-performance fanjet in a demonstration that combined elements of aerial ballet with raw power. This demo showed the crowd just how fast, how high and—whether at altitude or close in—how gracefully a ducted fan can be expertly piloted.

Geoff Combs flew his "ultimate biplane"—a Proctor Nieuport 28—as if it were a control-line stunt plane (no easy trick). Steve Buso flew his "Zap Machine" (a genuine control-line stunt aircraft) in an impressive, if dizzying, performance. Wayne Mann of Miniature Aircraft Supply sent a demo helicopter into an aerobatic routine that stunned the crowd, and Rave's Helicopter's "Doc" also performed an exhibition helicopter flight.

Bubba Spivey, of Lanier R/C, and his partner Wayne Voyles put on a team aerobatic performance

(Continued on page 83)

★ ★ ★

FLIGHT JUDGES

Stan Alexander

Bob Campbell

Darlene Frederick

Wayne Frederick

Tom Kozel

James Parker

Jim Semonian

John Smith

CHIEF JUDGE

George Leu

STATIC JUDGES

Bob Curry

Jack Dorman

Lee Henderson

CHIEF JUDGE

Tim Farrell

SCOREKEEPER

Jeff Troy

TOP GUN WINNERS

EXPERT CLASS

	Pilot	Aircraft	$Prize
1	Charles Nelson	Waco VKS7F	$2,000
2	Mel Whitley	Sea Fury	1,500
3	Diego Lopez	Skyraider	1,000
4	Terry Nitsch	F-86	700
5	Jeff Foley	Zero	500
6	Corvin Miller	Globe Swift	
7	George Buso	Nieuport 28	
8	Kent Nogey	F-86	
9	David Hayes	Rockwell Thrush	
10	Bill Harris	F-86	

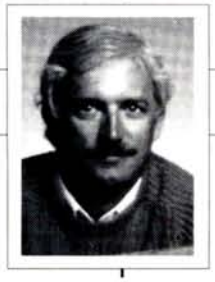
TEAM SCALE

1	Dean DiGiorgio/Bob Pickney	C-45 Beech	$1,000
2	Bob Violett/Jerry Caudle	F-16C	700
3	Jim Maroney/Maury Maroney	P-51	500
4	Nick Ziroli Sr./Bill Steffes	B-25	
5	Richard Rawle/Peter Guiver	Mosquito	

SPECIAL AWARDS

Award	Winner	Aircraft	Prize
Craftsmanship	Jerry Caudle	F-16	MAN Trophy
Critics' Choice	Roger Young	C-47	ACE Radio
Engineering Exc.	Peter Guiver	Mosquito	Robart Trophy, $200
High Static	Charlie Nelson	Waco	MAN Trophy, $50, JR-347 radio
Best Biplane	Richard Crapp	Antonov AN-2	RC Report Trophy, $200
Best Civilian	Corvin Miller	Globe Swift	Pacer Trophy, Sig kit
Best Military	Bob Pickney	C-45 Beechcraft	FTE Trophy, Dave Platt Kit/Retracts
Best Jet (tie)	Mark Frankel	F4D Skyray	BVM gift certificate and trophy
	Dave Malchione	T-33	BVM gift certificate and trophy
Best Markings	Jerry Caudle	F-16C	Aeroloft Cup
Best Buns (awarded by "Top Gun Hussies")	Diego Lopez		Trophy and Lanier ARF

AEROBATICS MADE EASY



DAVE PATRICK

SPINS

Slow the airplane down and add elevator to maintain altitude. The airplane will stall when you run out of useful elevator input. At that point, the nose will drop. If it mushes and won't stall, you have too little elevator throw, or the CG is too far forward. Start spinning the airplane at the point when the nose passes through the horizon line.

TO SPIN OR not to spin? That's a good question. Most planes will spin, but some are a lot easier to spin than others. Several factors affect an aircraft's ability to spin, but for a conventional plane, you can generally reduce them to CG (balance) and surface throws. Some aircraft don't recover easily from spins; in fact, some don't recover at all! So, before you start to spin your pride and joy, please follow the designer's set-up instructions carefully.

A spin occurs when an aircraft is stalled and then autorotates around its CG toward earth at a constant speed. If the speed builds, the aircraft doesn't stall, it spirals. Some airplanes spin in a fairly nose-down attitude, others in a flatter attitude. Many spin at about a 45-degree angle.

YOUR FIRST SPIN

Let's assume that you've set up your aircraft properly. Now climb to plenty of altitude (200 feet or more), point the nose into the wind, and cut the power to idle. You may want to climb slightly, as this helps to slow the aircraft more rapidly. As you slow down, you'll need an increasing amount of up-elevator to maintain altitude—until either the aircraft stalls or you run out of elevator and the aircraft mushes down, i.e., the airplane is still flying, but it's descending with the nose slightly down and full up-elevator. If it mushes, this means you haven't stalled, so it won't spin.

There are two adjustments you can make to help the airplane spin. Either add more elevator throw, or move the CG aft, i.e., toward the tail. I usually start by adding elevator throw in small increments until the plane stalls or becomes too pitch-sensitive at high speed. If your elevator is as sensitive as you like it and it still won't stall, try adding tail weight gradually. Eventually, with enough elevator and tail weight, your plane should stall. Remember, too much tail weight can mean disaster, so be careful.

Not all airplanes behave the same way after they've stalled. Some drop wing tips first and enter unprovoked spins. To recover, you must "unstall" the wing (I'll discuss this later). When your plane is near a stall, its air speed is low; under these conditions, rudder is the most powerful control. For example, you can use it to help your plane overcome a left, dropping wing so that it drops the right wing and enters into a right turning spin.

HERE WE GO

Now that you can stall the aircraft properly, you're ready to enter the spin. At the moment of stall, as the nose falls past the horizon (see diagram), apply full rudder and aileron in the same direction, and maintain the full up-elevator. Generally, left-turning spins are easier to enter than right-turning spins because the engine's torque can assist.

If the plane spun as defined, great! If not, you probably need more rudder throw. Don't be shy; go to high rate and add rudder until

your plane spins properly. In some planes, I've found that additional aileron can help as well. (Contrary to what some people claim, it can really make the difference.) There's a fairly small margin between an aerobatic setup and instability, so make changes to your aircraft gradually.

NOW WHAT?

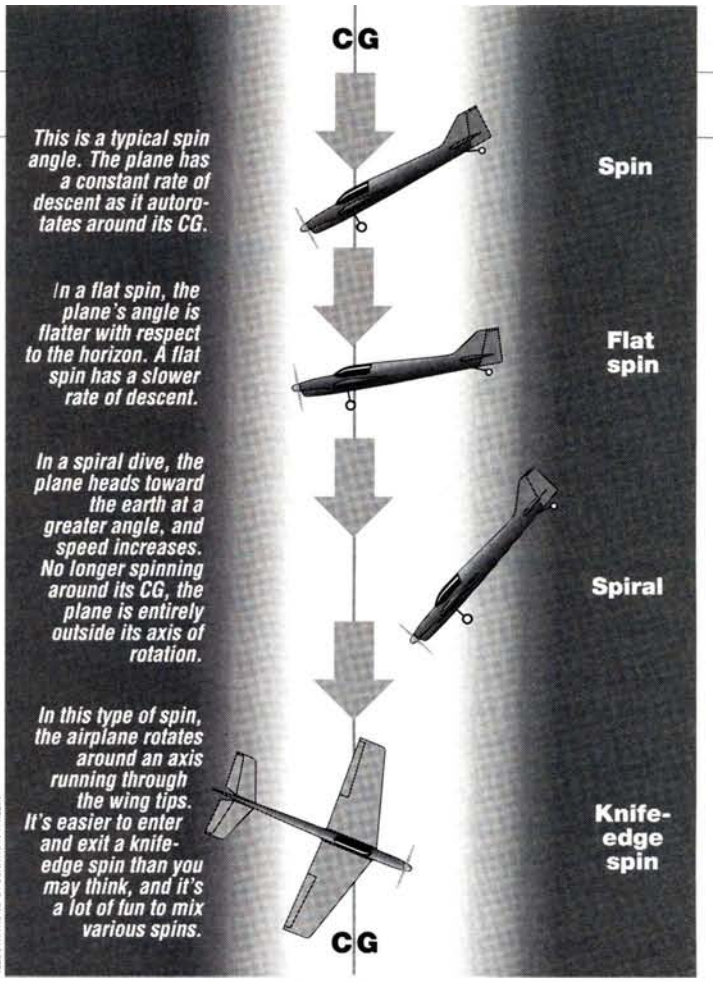
To recover from a spin, simply let go of the controls, and the autorotation should stop. The nose will point toward the ground, and air speed will be very low because the plane has just recovered from a stalled condition. At the moment of recovery, speed will consequently increase, but don't immediately pull up-elevator, or you may accidentally start another stall/spin. Let the air speed build slightly, and then carefully apply up-elevator to recover from the dive.

If you let go of the controls and the spin continues, you have a real problem. Before you give up, try some down-elevator and, if you can remember, rudder that's opposite to the rotation of the spin. That should do it. If it doesn't, hold down-elevator and opposite rudder, and add some power. If these methods don't work, start planning to repair your pride and joy. You gave it your best shot! The good news is, if it's in a true spin, it will descend fairly slowly, which can minimize the damage.

VARIATIONS

The spin you've just read about is an "inside spin from upright." An outside spin from upright requires down-elevator at the stall point (along with full opposing rudder and aileron), so that the plane will "pitch through" the horizon and keep going until it's in an inverted poisition. It will then be in an inverted spin. The spin entry is described as "outside" because it requires down-elevator to perform (just like an outside loop).

Your plane should be able to perform these other interesting spin variations with the same setup that enables it to do a conventional spin. If it can't, carefully adjust your aircraft as noted above, but also keep in mind that not all aircraft can perform all maneuvers.



COMPARISON OF SPINS AND THE SPIRAL

INVERTED SPINS

This time, approach from inverted, and stall as you did from upright, but use down-elevator to stall. Once the plane has stalled, add full rudder, opposite aileron and full down-elevator. Recovery is the same as in an upright spin, except that you'll recover to inverted using down-elevator. It's often easier to enter an inverted spin, but it can also be more difficult to recover from one, so beware. Also, if you must apply rudder to get out of an inverted spin, apply it in the same direction as the spin.

FLAT SPINS

Flat spins are really fun to do and watch, but your plane often must be set up on the edge of instability to perform a true flat spin. A flat spin is "more developed," i.e., the plane rotates and descends more slowly, and its angle in relation to the horizon is flatter. Some planes will develop flat spins from conventional spins after a few turns, but they generally must be coaxed. (I've also found that it's easier to flat-spin from inverted than from upright.)

To coax your plane into a flat spin, enter a spin, then try to remove aileron input slowly, or even add opposite aileron. A plane I recently flew required opposite aileron and then a slow application of down-elevator to coax it into a flat spin, but it was a beautiful flat spin! Sometimes, you have to experiment to find the right combination. A very important note: flat spins can be extremely difficult to recover from, so perform your first ones with plenty of altitude.

KNIFE-EDGE

The unusual-looking knife-edge spin is becoming more popular. Basically, instead of spinning around the nose, the plane spins around a wing tip. I've found that the easiest way to enter this maneuver is after you've established a conventional spin. Then, simply apply opposite rudder. On some planes, it only seems to work from inverted, but one thing is for sure: you'll lose altitude very rapidly, so start with plenty of height!

You can also change the type of spin as you perform it, e.g., upright to inverted to knife-edge. Just remember the recovery technique you'll need to get out of your fancy spin! Until next month....

SIMPLE PROGRAMMING

DAVID C. BARON

GETTING STARTED

WHETHER YOU'RE a sport flier, a competitor, or a novice, the one challenge you must meet is adapting your plane and flying style to changing flight conditions and flying requirements. Some of these changes are brought on by weather, some relate to the flying site, and some are the results of learning new maneuvers, such as those that may require mixing control surfaces.

To meet this challenge, your aircraft should be equipped with control systems that are reasonably easy to modify, and your radio should be flexible enough to fine-tune servo throws, rates and control mixes. The seemingly infinite combination of options offered by the new breed of programmable radios opens the door to a new era in our hobby. This column will examine ways to use this valuable new electronic capability. I'll look at the different makes and models of programmable radios, their strengths and weaknesses and how they're programmed. I'll describe programming steps and closely examine the areas of programming that the owners' manuals have neglected.

This month, I'll tell you how to get started with your new programmable radio.

KNOW YOUR STUFF

Purchasing a new radio is like purchasing a new car. There's usually a real need behind it, but then there's always a thrill in owning the latest high-tech machine that turns everybody's heads. You can tell yourself that it will make your plane fly better; maybe it can even make you a better flier...it certainly looks as if it should be able to at least make coffee! Just carrying it around the field can put a lot of swagger in your strut. Now that you have it though, are you sure that you're getting the most out of it? Are there some functions or capabilities that you haven't discovered yet? Where do you start?

After the pride of owning a new computer radio wears off a little (usually caused by trying to answer questions about its various functions), it's time to sit down in a comfortable chair and get intimate with your instruction manual. Don't let the size of the manual discourage you. It contains a lot of information that's best conveyed through the written word.

Read through the "Introduction" and/or "Before Using" chapter of your manual. Review the different display modes and key functions on the transmitter face, and familiarize yourself with the diagrams that show the names and locations of the switches, knobs and buttons that may be new to you. Keep your transmitter close at hand. You'll learn much faster if you locate and use each function as you read about it.

Before you get into programming details, install the airborne part of your new radio into an aircraft or heli. It doesn't have to be airworthy, but it should include all of the functions that you plan to use. Use servo tape if you like, because the point of this exercise is to provide working control surfaces while you learn about your new radio. To take advantage of some of the radio's best features, I strongly suggest that you install a separate servo for each aileron.

Now, you can work your way through the manual. Although you might not plan to use them all, try to experiment with each item in the program menu, because understanding them will show you how your radio "thinks."

"CRIB SHEET"

After you've explored all the functions, make a copy of the programming tree. This is the list of all the programmable functions that are available in the edit-display mode. (In some manuals, these are called "code functions.") Keep this list handy, e.g., in your field box, in case you have to modify a program in your radio at the flying field.

I suggest that you make notes on this diagram to help you remember the meaning and function of each code. (All radio manufacturers rely heavily on code abbreviations.) For instance, on the JR X-347, the code "LD" stands for "Landing Attitude Mixing," a function that mixes elevator throttle and flaps in preset amounts when the selected switch is "thrown."

In the next issue, I'll talk about increasing servo power and/or output travel by manipulating your programmable transmitter, and I'll show you how to get optimal performance from your servos.

I invite you to send in any problems (or creative solutions) that you may have encountered as you've programmed your radios. Be sure to include the make and model of your radio, as well as a rough description of your aircraft's layout, e.g., let me know if you're using a separate servo for each aileron. Include a complete description of what you're trying to accomplish. Send inquiries to Simple Programming, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

Altech ZLIN AKROBAT

by STEVE SCOTTO
AND DAVID C. BARON

[Editor's note: whether because of pilot error, atmospheric disruption or mechanical gremlins, the initial flight of Steve Scotto's Zlin lasted only seconds. About 300 feet from takeoff, the plane rolled and went in. A broken prop blade was found down a gopher hole. The test pilot and observers never agreed on the cause of the mishap. Jay Weiner, a member of our flight test team, built a second Zlin, and David Baron did the flight analysis in a very successful follow-up.]

WE ALL KNOW what "ready to fly" means, but what kind of beast is "ready to cover"? The Altech* Zlin Akrobat 526 kit is one answer. It contains factory-built wings, tail feathers and a fuselage. All you have to do is join the major components, pick a color scheme, cover the Zlin with your favorite material and install your radio and engine, and it's ready to fly. Tired of the cookie-cutter look at a field cluttered with ARFs? Ready to enter the new fun-scale event? The Altech Zlin may be just what the model doctor ordered!

THE KIT

The Altech Zlin is a high-quality wood, foam and ply plane. The foam-core wing and tail surfaces are sheeted with a light, thin, wooden veneer that's only part balsa. The fuselage is a beautifully formed wooden shell over a very minimal framework. The craftsmanship and light, sturdy construction of these components is striking. A plastic cowl and a clear canopy are supplied, as are all necessary hardware and linkages. The wheels, fuel tank, covering and pilot aren't included.

FLIGHT PERFORMANCE

by David Baron

The Zlin used in this flight test was powered by an O.S. .46 turning a 10x6 Master Airscrew* prop. The plane was built completely stock, without retracts. Several test flights were performed in conditions that ranged from still air to a 15mph wind.*

PHOTOS BY TOM ATWOOD AND YAMIL SUED

- **Takeoff and landing**

The Zlin handles reasonably well on the ground. Right rudder was required for takeoffs, but not in unusual amounts. In a crosswind takeoff, use rudder with authority (but without over-controlling) to maintain the plane's heading; if you don't, it will "weathervane" into the wind. This plane is eager to fly and breaks ground naturally as soon as it has enough air speed. We flew the plane off grass, and the first sizeable lump of soil it hit was enough to bounce it into the air. I suggest that you allow the aircraft to accelerate immediately after liftoff, just in case it's in the air prematurely, e.g., because of a bouncy runway.

The Zlin's excellent tracking carries it through a landing approach as if it were on rails. The plane's clean lines allow speed to bleed off slowly. The cowl on the engine eliminates a lot of drag, so take care that you don't touch down farther down the runway than you intend to. The aircraft has a natural flare that lets it touch down at a very comfortable speed, and it doesn't have to be powered-down to the field like some heavier, less predictable ARFs.

One of the Zlin's shortcomings becomes apparent when it touches down too hard. The landing-gear wire is too soft for the weight of this aircraft. I don't think that the gauge of wire is wrong, just the temper. Our gear didn't act like music wire, but we didn't replace it. Rather, we used it as a "G" meter to gauge the landings of all those invited to fly the plane!

- **High-speed performance**

Whenever this plane gets up a head of steam, it goes only where it's pointed. It's fast—too fast for a beginner. No trim changes are necessary to switch between fast and slow flight.

- **Low-speed performance**

The Zlin behaves predictably, and the ailerons remain effective up to the stall. When it does stall, it tends to drop one wing, but only after it has lost all of its air speed. Never use ailerons and rudder to fight a stall this deep. Only lowering the nose and regaining air speed will keep the plane out of an unwanted snap roll or spin. Because it handles reasonably well at low speed, the Zlin is quite predictable when flown dead-stick.

- **Aerobatics**

What would you like to see? This airplane does it all with grace. Fast or slow rolls are very solid. You need minimal rudder and elevator to maintain altitude. Snap rolls are violent but predictable. The Zlin recovers from a spin within one revolution after you release the stick.

Flat spins stop all the action at the field. This plane does an authentic upright flat spin with the tail quite low and the rotation somewhat fast. Recoveries are quick, but they depend heavily on the response of the engine. Use only opposite rudder and full power to recover!

Loops are very comfortable if they're big, but use caution if you want a small loop. Too much elevator throw will result in the plane snapping out. Determine the maximum elevator throws that produce the tightest loop without the plane snapping out, and match those throws with the maximum stick deflection. The ease of knife-edge maneuvers depends on the power of your engine. The Zlin has ample rudder and fuselage to fly in a predictable knife-edge attitude from horizon to horizon. It's as at home inverted as it is upright, and performs the same in relatively steep winds as it does in calm air. Although it's too fast for beginners, it would be an excellent first pattern trainer for pilots who have conquered ailerons and want to explore the world of aerobatics further.

★ ★ ★ ★ ★ ★ ★

ZLIN AKROBAT

The light tan primer that has been applied to the wooden parts has made their surfaces rough, so sand them lightly.

Because so much of this kit has been built, you can assemble it fairly quickly. All hinge slots have been cut and are easy to align. Plans aren't included, but they aren't necessary. The kit contains a 16-page photo-illustrated construction manual. These instructions can be a little incomprehensible at times (they appear to be a direct translation from a Far Eastern language and they could use some editing), but the construction is very simple, so this isn't really a deterrent.

WING ASSEMBLY

I began construction with the wing assembly. I added Carl Goldberg* retracts to the plane, and they fit nicely. This is a feature found in the full-scale version, and tucked-up wheels really add to the fun! The kit comes with fixed landing gear, but it doesn't include instructions for retract installation. I made all the modifications before I joined the wing panels.

The wing has a beefy main joiner that extends 6 inches into each panel. Fit it carefully; it should be snug without cracking the thin veneer that covers the wing. Next, install the aileron torque rods and the tapered trailing-edge fairing. The kit includes a lightweight nylon material that you can use to form the wing cuff, but I used 6-inch-wide fiberglass tape secured with epoxy. Unfortunately, the supplied ailerons were warped, so I replaced them with $^{5}/_{16}$x1$^{1}/_{4}$-inch aileron stock.

The installation of the leading-edge wing-mounting dowels is a little unusual. The fuselage mounting holes have been drilled, and the directions suggest that you place paint-smeared wads of soft cloth in these holes. When the wing is pressed into place, the paint will mark where you should drill for the wing-mounting dowels. This system worked, but take great care to do it correctly and check your work frequently before you drill any holes. This system was also used to position the holes for the wing-mounting bolts.

Building the fuselage is simplicity itself. Just epoxy the stabilizer, the vertical fin and the dorsal fin into place. They fit well, and you don't really have to fiddle with them to make them line up correctly. The cowl, which only requires a little sanding, is held to the fuselage by screws that are anchored in small blocks that have been epoxied to the firewall. Mount a spinner and a prop on the engine before you drill the cowl for the mounting screws.

ENGINE INSTALLATION

The engine is mounted upside-down on extremely beefy mahogany beams, and the cowl

ZLIN AKROBAT

SPECIFICATIONS

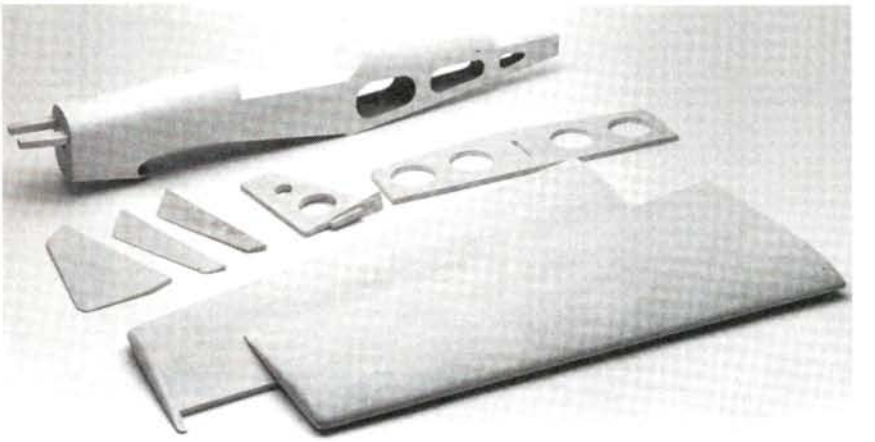
Model Name: Zlin Akrobat
Manufacturer: Altech
Type: semi-scale sport aerobatic
Price: $159.98
Wingspan: 54 inches
Wing area: 540 square inches
Wing loading: 24.5 ounces per square foot
Weight: 5.5 to 6 pounds
Length: 43 inches
No. of channels req'd: 4 (throttle, elevator, ailerons, rudder/tail wheel)
Power required: sport .40 to .45 2-stroke or .48 to .53 4-stroke
Prop used: 10x6 Master Airscrew
Airfoil type: semisymmetrical
Washout: not built-in
Wing construction: sheeted foam
Kit construction: conventional wood (balsa and falcata wood)

Features: this "ready-to-cover" kit requires assembly but little building. Hardware includes landing gear, tail assembly, aileron control horns, polypropylene flexing hinges, a clear plastic canopy and an ABS cowl.

Hits:
- Quick construction
- Well-built
- Good aerobatic flight performance

Misses:
- Landing-gear wire should have been stiffer
- Some difficult passages in the instructions

* * *



The few parts require assembly, not construction.

must be cut out to accommodate the muffler, the cylinder head and the needle valve. I use a Du-Bro* Quik Fill valve so I can fill the tank without disturbing the cowl. Be sure that the muffler won't interfere with securing the cowl, or with fueling when everything is in place. I fitted the test model with an Enya* .40 CX 2-stroke engine, but the very long mounting beams could easily accommodate a 4-stroke engine.

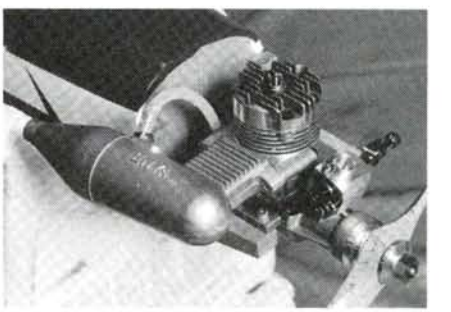
I installed 1/8x1/4-inch hardwood underneath the plywood servo-mounting plate to provide a little more "grab" for the screws. The radio installation is very straightforward, and I encountered no problems using the supplied hardware, but the supplied clevises won't fit standard 2-56 rods.

FINAL ASSEMBLY

I covered the Zlin with MonoKote*. The color scheme is a simplified version of one that was used by the British Aerobatic Team when they flew Zlins in the '70s. Some of these planes have been sold into private hands in the U.S. Air shows or fly-ins can provide the documentation for a truly custom paint job! I use a 1/6-scale pilot bust, which really enlivens the plane.

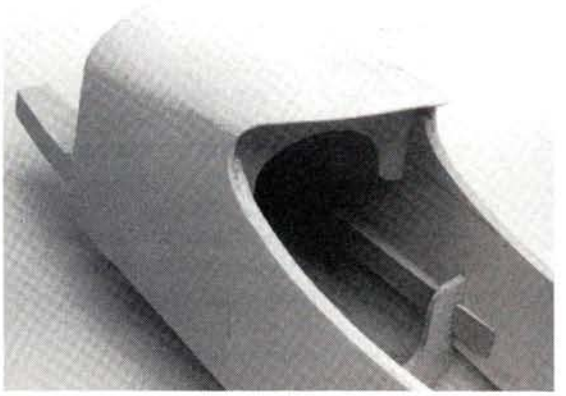
After I had completed the assembly, a close examination by Chris Chianelli—we call him "Eagle Eye" in Brooklyn—turned up a serious problem. The pre-drilled and tapped holes for the wing-mounting screws were too big! The screws held long enough for construction and a preliminary once-over, but wear left the screws turning freely by the time I was ready to fly! Check your model before you fly! *[Editor's note: the second Zlin kit didn't have oversize holes.]*

We greased the nylon bolts and smeared the threads with epoxy, then we lightly filled the holes with more epoxy and then turned the screws in place. After the epoxy had hardened, we removed the screws, leaving behind very strong, custom-made threads. (Brass inserts could also have been used.) If this problem hadn't been fixed, the wing and fuselage might have parted company during the first (and, if so, the last) loop.



The Enya .40 is shown mounted on Steve Scotto's Zlin.

Despite this, the Zlin Akrobat is a well-designed prefabricated kit that's suited to sport fliers who want to hit the flying field without spending a lot of time at the workbench. There are many interesting paint schemes for this plane, and its simple construction makes it a good candidate for kit-bashing. On to the flying field!



The level of craftsmanship in the Zlin's components is fairly high, as you can see in this view through the wing saddle.

**Here are the addresses of the companies mentioned in this article:*
***Altech Marketing**, P.O. Box 391, Edison, NJ 08818.*
***Carl Goldberg Models**, 4734 W. Chicago Ave., Chicago, IL 60651.*
***Du-Bro Products**, 480 Bonner Rd., Wauconda, IL 60084.*
***Enya**, P.O. Box 286, Fords, NJ 08863.*
***MonoKote**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***O.S.**; distributed by Great Planes Model Distributors.*
***Master Airscrew**; distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*

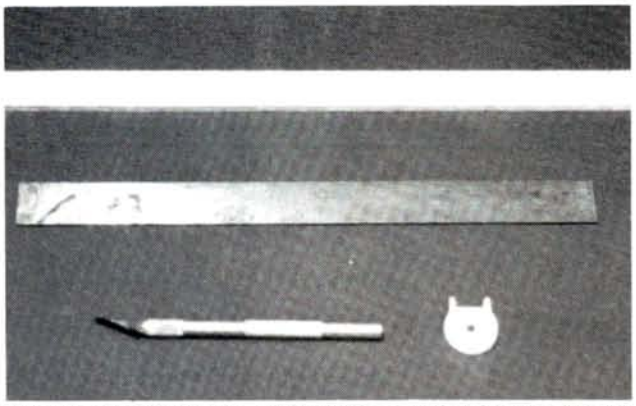
HOW TO

GEORGE VOSS

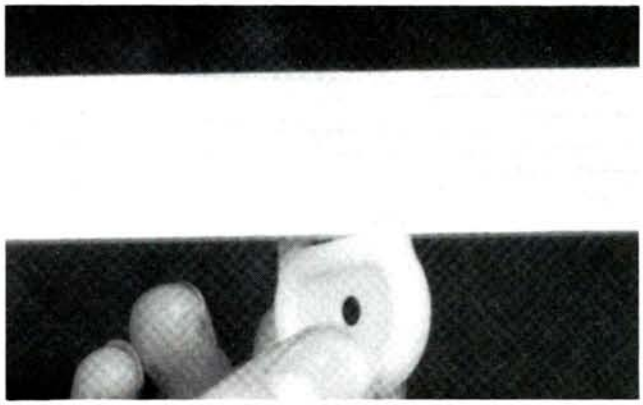
Quick Leading-Edge Bevels

FAST AND TRUE

LET'S FACE IT: sanding isn't on anyone's "10 most exciting things to do" list. Here's a way to reduce the time spent sanding leading-edge bevels on ailerons, elevators and rudders by 90 percent.

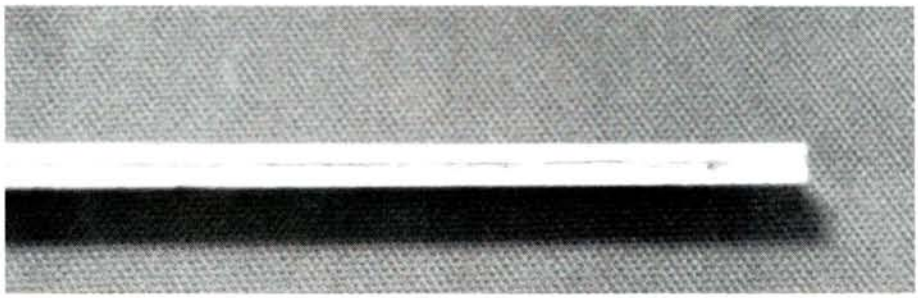


1. You'll need a sharp knife, a straightedge and a Carl Goldberg Models* hinge-centering tool.

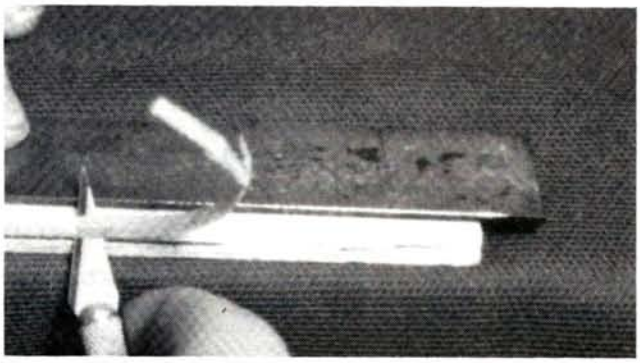


PHOTOS BY GEORGE VOSS

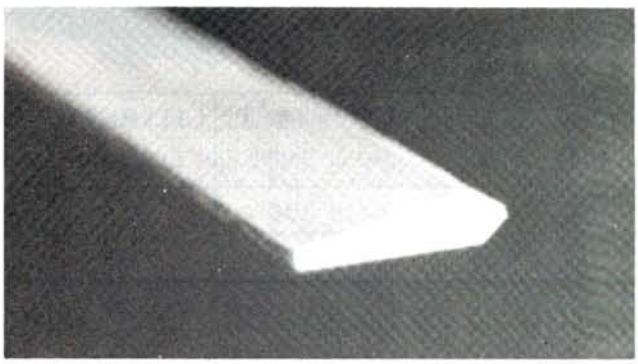
2. Using the centering tool, notch a groove in the aileron leading edge.



3. To help you see the groove, highlight it with a fine-point marker.



4. Place the aileron on the edge of the table. Lay the straightedge on the top surface of the aileron, approximately 1/4 inch back from the leading edge. (This distance will depend on the thickness of the straightedge and the desired bevel angle.) Using the straightedge and the center line as guides, bevel the aileron leading edge. The aileron shown is made of fairly soft balsa. If you use hard balsa, cut carefully to avoid splitting the aileron stock.



5. The freshly cut aileron. Notice that the aileron leading edge doesn't come to a sharp edge. Sand-in a sharp leading edge after you've cut the hinge slots. It's that easy, and the curve that runs along the leading edge will be consistent and true.

**Here's the address of the company mentioned in this article:*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

LANIER

FUN FLY 40

Fly-Natics Rejoice

by REED KALISHER

IF YOU'VE EVER been to the WRAM Show, MARCS, Toledo, or any of the regional shows, and you've stopped by the Lanier RC* booth, then you've met Bubba Spivey. He stands at his booth, sometimes with his dad, and together they beat the bejeebers (if you can have a "Bubba," you can have "bejeebers") out of an airplane fuselage. Holding it by the tail like a baseball bat, they pound it on the table to prove a point. No, they're not crazy. On the contrary, they're demonstrating the durability of Lanier aircraft.

Bubba knows airplanes. He knows that those of us who purchase ARFs do it because we don't have the time or the skill to build the kinds of plane we'd like to be flying, or because we're beginners who don't want to spend a lot of time building a plane that's destined for rough treatment. If we don't have the time to build, we don't have the time to repair, so Lanier sells replacement parts, too.

Lanier manufactures a line of about 20 models (most are ARFs) for engine sizes from .19 to 4.2ci. The Fun Fly 40 is a shoulder-wing ARF sport plane. The foam-core wings are plywood-spar-reinforced and covered with Aerosheet.

PHOTOS BY REED KALISHER

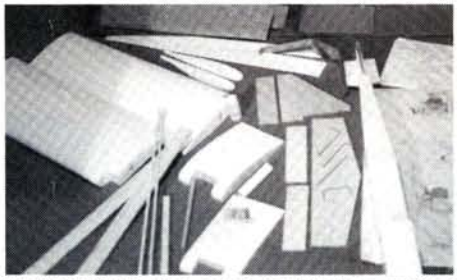
Model name: ..... Fun Fly 40
Manufacturer: ..... Lanier RC
Type: ..... Sport monoplane, ARF
List Price: $99.95
Wingspan: ..... 48 inches
Wing area: ..... 516 square inches
Weight: ..... 3.75 to 5 pounds
Length: ..... 35.5 inches
No. of channels req'd: ..... 4 (aileron, elevator, rudder, throttle)
Wing loading (as tested): ..... 22.34 ounces/square foot
Power req'd: ..... .19 to .45
Engine used: ..... Enya SS .45
Prop used: ..... Master Airscrew* 11x7
Airfoil type: ..... Semisymmetrical
Wing construction: ..... Foam-core with plastic sheeting
Kit construction: ..... ABS plastic with balsa empennage

SPECIFICATIONS

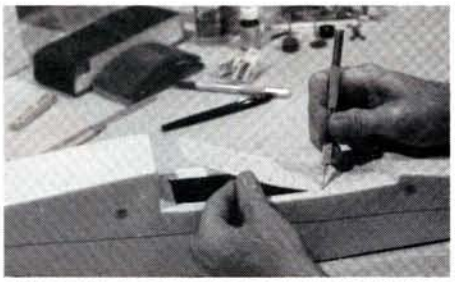
Features: this easy-to-build design has an incredible fun-fly performance envelope, and it can be assembled in less than 12 hours.

Hits
- Simple assembly
- Instructions include full-size plans
- Materials are of high quality

Misses
- The kit contains no hardware
- The recommended fuel tank holds only 6 ounces, and the fuselage won't accept anything larger than an 8-ounce tank.



The ARF kit in the box, complete with plans, sections and wrapping paper.



Drill small holes at all sharp angles in the plastic to prevent cracks from starting, then "connect the dots."

The fuselage is vacu-formed ABS around a plywood crutch with a balsa empennage. Although some Lanier kits are offered in a choice of colors, the Fun Fly comes only in white.

THE KIT

When you first open the box, ya gotta be impressed! The carton is sectioned, and every part is protected by paper. Nothing rattles, so nothing gets damaged. Hardware isn't included, but everything else is, and the quality is excellent. The instructions are the real treat. Now, I'm not a novice builder, but I do appreciate it when the instruction booklet is clear and concise. Every Lanier kit includes full-size plans, a bill of materials and an instruction booklet. The booklet even includes an exploded view of the entire airplane, and that makes parts identification a snap. As useful suggestions are received by Lanier, they're evaluated and added to the instructions. This is a company that cares and listens to you, the builders and fliers of Lanier products.

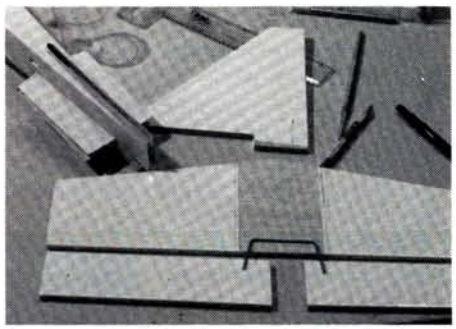
Bottom line: I'm impressed, and I haven't even started yet.

CONSTRUCTION

The plans suggest that you start with the wings, so guess where I started? (No, I did the wings!) They come in two, very basic halves. Each trailing edge accepts a sanded balsa strip to which the ailerons will be attached. Use a hardwood dowel and epoxy to align and join the wing halves. Keep a bottle of alcohol handy (rubbing alcohol, not Jim Beam), as it's perfect for cleaning excess epoxy off the plastic parts.

This easy-to-build design has an incredible fun-fly performance envelope, and it can be assembled in less than 12 hours.

Now, we're asked to use a bottle of "airplane cement." When you open it, you may recognize the odor of MEK (methyl ethyl ketone), which is an ingredient in some plastic glues. Caution: MEK fumes can make you ill and burn your eyes, so be certain to have adequate ventilation.



The tail assembly and the control components with the fuselage. Note that the trailing part of the fuselage has been trimmed so that it's open.

MEK melts plastic (that's how it bonds), so use it very sparingly. (I applied it with a very small brush.)

After using the MEK to attach the plastic parts, we're asked to seal with CA. Another caution! CA will melt the foam-core if it makes contact. I suggest that you use one or all of the

FLIGHT PERFORMANCE

I had been waiting for six weeks for a dry weekend. Today was the day! The sky was clear and the winds were manageable. After a pre-flight check, I lined up and gave it the gun.

- **Takeoff and Landing**
  Ground tracking was good, because the tail wheel is perfectly aligned with the rudder (if you install it properly). Liftoff took place in less than 20 feet, and the initial climb-out was at an astounding angle of attack. The plane climbed out so quickly that I immediately chopped the throttle to half and fed in down-elevator trim (just a few clicks). A tiny amount of left-aileron trim was needed, and I was all set to enjoy a great first flight.

  Landings are a little hot. The plane weighs 5 pounds, and it requires slightly more power than idle on final approach, although in a dead-stick, it's still very controllable. The appearance of the Fun Fly 40 belies the fact that it doesn't bleed off air speed easily, so tight fields might be a little tricky for novices. When the plane is floating over the ground, however, it retains control right down to the final stall.

- **High-Speed Performance**
  Tracking is flat and true at all speeds, and it requires no additional trim adjustments. If you don't pay attention, it will slowly gain some altitude, but not enough to warrant playing with the trim. Once again, the plane will fly much faster than its looks suggest (with a .40 to .45). Novices will appreciate the ease of control afforded by the plane's incredible stability.

- **Low-Speed Performance**
  After you bleed off the air speed, the plane remains as stable and tracks as flat as it does at high speed. I wanted to test its stall characteristics, so I attempted two powered stalls and two powered-back stalls; each time, the plane fell nose-down with no roll-off tendencies. The semisymmetrical wing performs beautifully.

- **Aerobatics**
  I'm not a pattern pilot, but I put the Fun Fly 40 through some basic maneuvers. Tight loops and wide loops were completed with no aileron correction. Hammerhead turns came out on the same line they were entered from. I tried some snap rolls, and I was astounded! The plane corkscrewed so quickly that I almost couldn't follow it. Later, I reduced the aileron throw and the roll rate was still great—just not as twitchy. Inverted flight required about 25 percent down-elevator. Spins had to be forced, and recovery was instantaneous. The only maneuver this plane wouldn't do was an outside loop! I can find no reason for this, and Bubba (remember him?) told me that other people have reported the same thing. Its overall performance is so good that I really don't mind. A friend of mine who flew for me while I photographed the plane commented that the Fun Fly 40's performance rivaled that of his his .40 Laser!

  I give the Fun Fly 40 very high marks for performance, and I recommend it to anyone except beginners.

following: a CA foam primer such as Zap* Zip Kicker for foam, or one of the foam-safe CA glues. Remember that MEK and CA will leave permanent fingerprints on the plastic surfaces, so watch your fingers. Lanier includes a strip of trim material that can be used to cover gaps and seams made when plastic is removed or attached. Top and bottom ABS center sheets are applied and trimmed using the method just described.

The ailerons and the tail feathers are sanded and covered, then mounted with Klett* Flex Point hinges. To ensure free movement, be sure to trim away the excess plastic near all the hinge and control-horn areas.

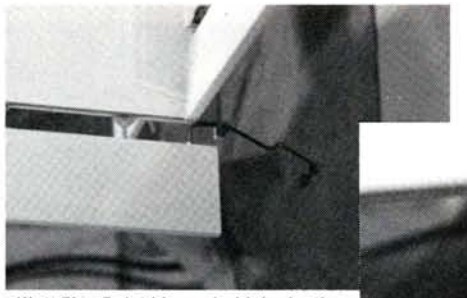
As useful suggestions are received by Lanier, they're evaluated and added to the instructions. This is a company that cares and listens to you, the builders and fliers of Lanier products.

You can use a sharp hobby knife to cut open the fuselage at the wing saddle. I used a Dremel tool with a cutting disk. Whichever method you choose, be careful. The plastic is heavy, but your knife may slip through a soft spot. If you use a power tool, wear eye protection, because the plastic will be thrown off in hot bits that can injure your eyes. Common-sense safety is always advisable.

Now, the wing-alignment dowels. Follow the measurements on the plans exactly when drilling, or you'll miss hitting the spar in the wing, and its support is vital. The same is true of the wing bolts; take your time lining everything up before you drill. A servo slot will be cut out later, and the wing is done.

The fuselage is already finished. You only have to attach the covered empennage and the landing gear to it. Remember, cut away all the excess plastic at the rear of the plane where the tail feathers will be inserted, or the control surfaces won't have the required freedom of movement.

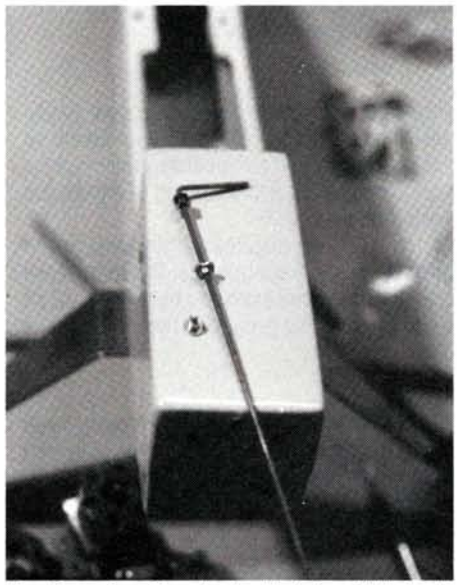
The tail-wheel assembly is made out of wire and a strip of plastic (both included). The wire is of a very heavy gauge, and it proved to be a "bear" to bend! The plastic is used as a stress-relief support. (Save the rest of the plastic for repairs.) If you wish, you can substitute an after-market tail-wheel assembly, but I had no problems using the included system.



Klett Flex Point hinges hold the feathers on. Note the tail-wheel assembly.

Installing the engine vertically with an exhaust diverter is an excellent alternative to installing it at a 45-degree angle.

It's recommended that you install the engine at a 45-degree angle to direct the exhaust away from the wing. I found that when I went to drill the top mounting hole, the drill missed the plywood firewall behind the plastic shell. My solution was to install the engine vertically and use an exhaust diverter. I actually find that this works perfectly, and the after-flight clean-up is minimal. The plans call for 4-40 mounting bolts, but I felt better using 6-32s. To get the blind nuts into the nose, use a length of piano wire bent at 90 degrees. I put a wheel collar onto the wire, as it holds the nuts straighter.

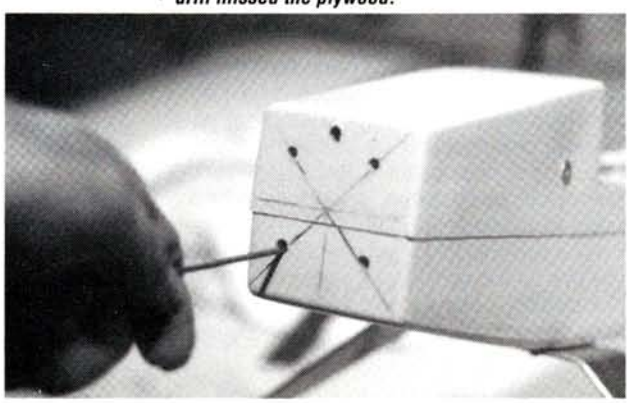


Use piano wire with a wheel collar to insert blind nuts into a tight nose. Pull to set the blind nuts. The top hole was an attempt at 45-degree mounting, but the drill missed the plywood.

The recommended 6-ounce tank is kind of small for a hot, Schneurle-ported .40 engine. I managed to squeeze in a 10-ounce Sullivan* Flex tank, but after the battle (and subsequent fuel-line crimping), I recommend an 8-ounce tank, which is better suited to the fuel draw of a .40 without a pump. The battery pack fits under the tank, so be sure to pad and wrap it in a plastic bag.

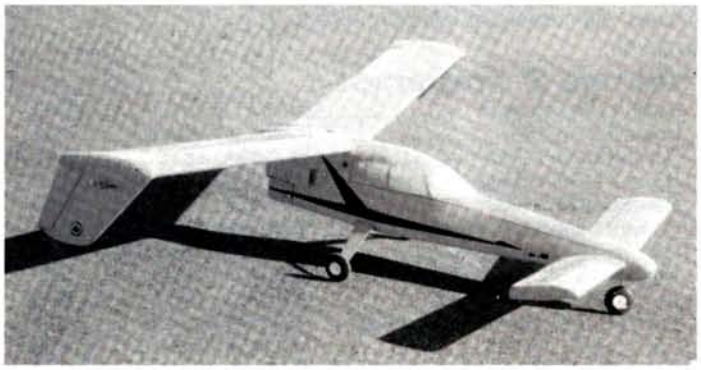
The radio fits the radio bay snugly; be careful to allow clearance for the aileron control rods, and install your engine. I selected an Enya* SS .45 (I like the extra power), and an 11x7 prop. Attach the linkage as shown. The recommended throws are fine unless you're a novice pilot. (If so, use less throw, especially in the ailerons.)

My plane balanced out a little tail-heavy and required 4 ounces of nose weight. It finished at 5 pounds even. Now decorate it to your liking, check all linkages, throws and plumbing and go fun-flying!



**Here are the addresses of the companies mentioned in this article:*
***Lanier RC,** P.O. Box 458, Oakwood Rd., Oakwood, GA 30566.*
***Zap;** distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.*
***Klett;** distributed by Carl Goldberg Models, 4734 West Chicago Ave., Chicago, IL 60651.*
***Sullivan Products,** P.O. Box 5166, 1 North Haven St., Baltimore, MD 21224.*
***Enya Model Engines/Altech,** P.O. Box 286, Fords, NJ 08863.*
***Master Airscrew;** distributed by Windsor Propellor Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*

HOW TO



Canada Goose, Canard was a great learning experience. Power is a .35cid engine. Like all models pictured here, it features stressed-skin construction, low drag; and slotted flaps.

Stressed Skin Design

PART 1

Build stronger, lighter models

by ANDY LENNON

IT'S A sound engineering principle that, to maximize strength and to minimize weight, the structural material should be located as far from the "neutral axis" as possible.

This two part series will explain, in simple terms, what this neutral axis business is all about; and how to arrange the structure of your model for maximum strength without adverse weight penalty.

To start with, a nodding acquaintance with basic forces is needed. There are only four:

(1.) Tension
(2.) Compression
(3.) Shear
(4.) Leverage

• Tension ↔
Pulling on an elastic band puts it under tension. The arrows show the directions of the forces.

• Compression → ←
Opposite of tension. A column supporting a roof is under compression.

• Shear ⇆
Forces opposed to one another. Cutting paper with scissors is "shearing". Each blade opposes the other.

• Leverage
A 90-pound person sitting 2 feet away from the balance point of a seesaw will be exactly balanced by a 60-pound person sitting 3 feet from the same point, but on the opposite side. The greater leverage on the lighter person's side offsets the other's greater weight. Both sides have 180 foot/pounds of leverage.

These forces exert themselves in a variety of ways:

Bending. Here, all four forces come into play. Figure 1 shows a balsa strip, 1/2 inch square, being bent.

The fibers on the outside of the bend are being stretched—under "tension."

On the inside of the bend, they are being pushed together under "compression."

These opposing forces develop "shear." In our balsa strip, that shear acts on a line midway through called the "neutral axis."

Now look at Figure 2A. This shows the end view of the 1/2-inch-square balsa stick. The neutral axis and the "leverage" from the centers of the balsa areas above and below the neutral axis are shown.

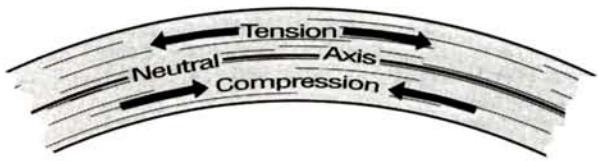


Figure 1—BENDING

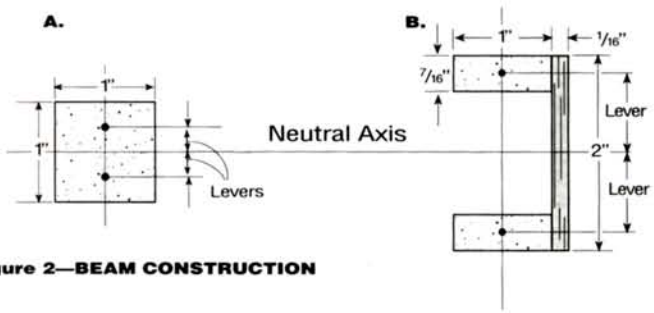


Figure 2—BEAM CONSTRUCTION

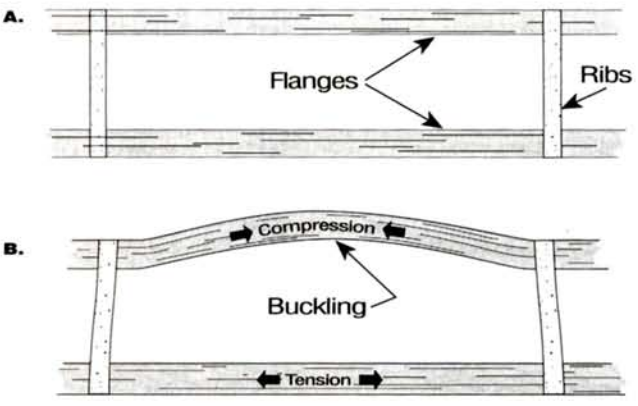
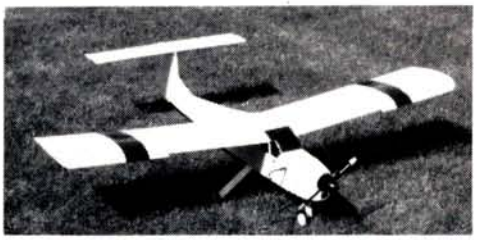


Figure 3 — FLANGES BUCKLING UNDER LOAD



Snowy Owl. The external glow-plug power plug is in the jack. Plug removal is safely away from the dangerous rotating prop. It's .40cid powered.

Consider Figure 2B. The beam is composed of balsa upper and lower flanges, 1/2 inch by 3/16 inch in size, joined by a balsa web 1/16 inch in thickness *with its grain vertical.* Both A and B have the same cross-section areas.

Obviously, the "leverage" from the neutral axis to the flange centers is greater in "B" than in "A." "B" will be substantially stronger than "A" in bending *because the material is farther from the neutral axis.*

The balsa web in "B" is under "shear" in the bending of the beam. Balsa is much stronger in shear *across* the wood grain than *along* the grain; and stronger *along* the grain in both tension and compression.

Consider Figures 3A and 3B that display the same beam as in Figure 2B, but without the balsa shear web—and as part of a wing structure under flight loads. The upper flange is under compression, and the lower is under tension.

Failure will occur by the upper flange *buckling* as shown in Figure 3B; and *in the absence of the web,* the opposing forces will distort the structure.

With the vertical-grain shear web in place, the buckling is resisted as are the shear loads. These webs add much strength for little additional weight.

Obviously, the farther apart the flanges are, the stronger the beam; or, by reducing flange size, and weight, you can obtain the same strength.

A thicker wing can be made strong but light; its spar flanges are farther apart and smaller.

Torsion is composed of shear and tension. In Figure 4, a tube is being twisted in opposite directions at its ends. The arrows in the center show opposing shear forces, and the twisting is tending to elongate the fibers in tension.

In Figures 5A and 5B, "A" is a solid cylindrical rod; "B" is a hollow cylinder with the same cross-sectional area of material as "A."

Again, "B" is much stronger in torsion *and bending* than "A" because of the material's greater leverage from the neutral axis.

There's a limit to this leverage length, i.e., the point at which you can still retain the same cross-sectional area of material; beyond this limit, the outer skin would become so thin that it would fail by local buckling under load.

Full-scale airplanes have thin-skinned fuselages reinforced by lateral frames and longitudinal stringers to resist buckling.

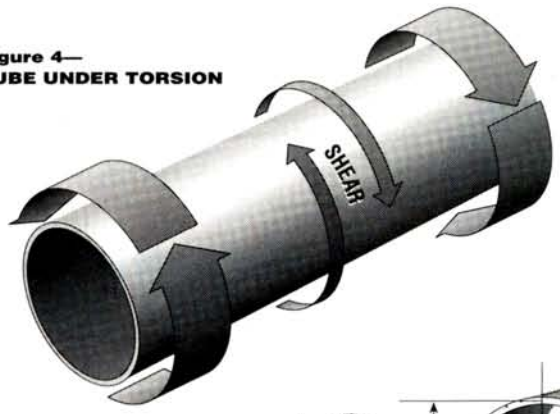
A beam such as that in Figure 2B is weak in torsion. Figure 6 illustrates this beam in a wing.

An airplane wing, in addition to bending loads from lift, must resist drag and torsion loads. Drag loads are due to air resistance or drag. Torsion loads result from the airfoils' pitching moment and from the twisting action of ailerons in opposite directions; and the nose-down loads of flaps when extended. These loads are all substantially increased in high-speed maneuvers such as steep turns, sharp pull-ups, etc. where centrifugal forces come into effect.

The D-spar structure of Figure 6 is designed to resist all these loads. It combines a cylinder and a beam. Note that the material is as far from the neutral axis as possible and that the beam is close to the wing's thickest point.

Ailerons and flaps, as mentioned, impose loads that, on larger models, require a second spar in front of these surfaces, with some torsion-resisting structure. Part 2 will provide detail of second-spar designs.

Figure 4—
TUBE UNDER TORSION



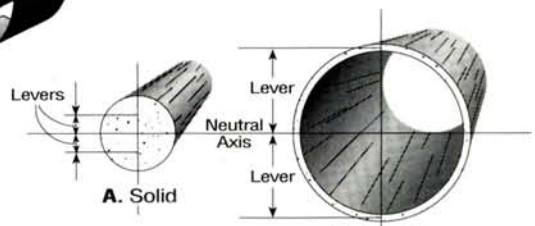


Figure 5—ROUND STRUCTURES

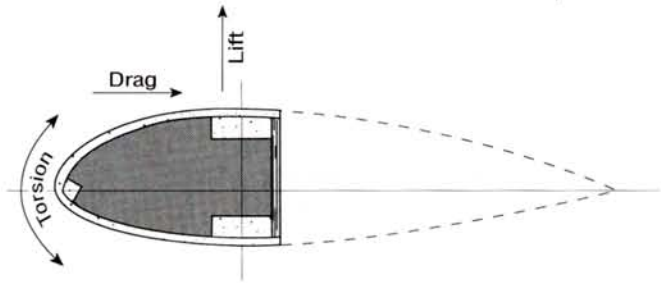
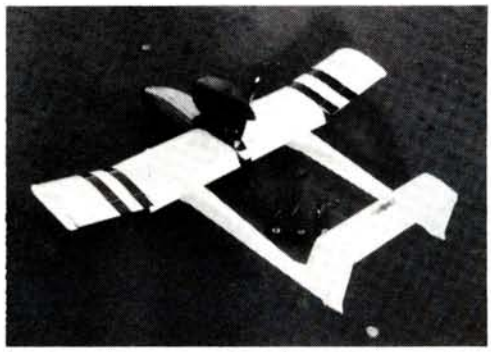


Figure 6—D-SPAR WING STRUCTURE



Sea Loon .15cid-powered twin-boom flying boat. Flaps are fully extended.

Full balsa sheeting in 1/16-inch balsa skins, top and bottom of the wing, maintains the airfoil section and adds little weight, but considerable strength.

Ribs may be "capstripped" between spars, with the covering sagging between the ribs reducing the airfoil's integrity.

Both fully and partially sheeted wings are covered with your choice of materials.

The grain of the 1/16-inch skin runs parallel to the span to resist torsion and drag loads across the wood grain; and the skin aids the spars in tension and compression loads parallel to the grain.

Horizontal and vertical tail surfaces have to contend with, principally, bending loads as elevators and rudder operate. The same structural principles apply.

Fuselages encounter a wide variety of loads in flight, and particularly on landing. A tubular structure is best able to resist the heavy bending, twisting and tension loads.

In balsa, a tubular or oval well-streamlined fuselage is difficult to produce. In fiberglass, it can be done, but the molds required are expensive for "one-off" models.

The compromise, in balsa, is flat sheet sides, top and bottom with generous corner radius. This comes closest to the local round or oval cross section.

It always surprises me to find how strong stressed-skin structures become after assembly of pieces of flimsy balsa. Built straight, they do not warp. Models built 10 years ago are in flyable condition today.

Part 2 will detail wing, tail and fuselage structures of stressed-skin design for the Swift.

CENTER ON LIFT

MICHAEL LACHOWSKI

SOFTWARE UPDATE, CATAPULT LAUNCHING, NEW AIRFOIL

THIS MONTH, I'll discuss software for designing models, a catapult for hand-launch gliders (HLGs) and a new airfoil design for the tails of ASW-24 standard-class sailplanes. I think that all of these subjects will be of interest, but don't just leave it up to me. If you have suggestions for this column, write to me care of *Model Airplane News*.

CATAPULT LAUNCHING

Chasing thermals at low altitude with HLGs is challenging and fun. With wingspans of less than 60 inches, these planes can circle tightly in low thermals. Although most weigh only 10 to 16 ounces, it takes a strong arm to get a reasonable altitude. Fliers who wrecked their arms years ago with free-flight HLGs definitely have problems. What's needed is a simple launching system that will propel the aircraft to an adequate height and make HLG flying a contest of skill rather than of athletic ability.

Terry Lisansky launches his Vertigo. Here, the hook is mounted near the nose.

Skip Williams of the Silent Knights Soaring Society (SKSS) developed a simple setup based on a free-flight catapult system. (The SKSS holds an annual contest with a hand-launch class and a catapult class.) It looks like a big slingshot, and it will launch an HLG slightly higher than a good hand-launch will. It consists of 20 feet of 1/8-inch-diameter rubber tubing that's attached to two poles, and a short line with a tow ring on each end. The tubing is slid through one ring and the tow hook is attached to the other.

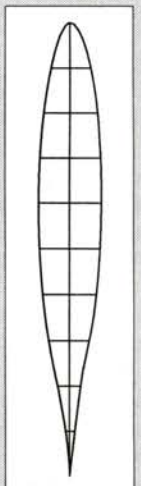
To use Skip's system, you must establish a launching area that will prevent the tubing from being stretched so far that it breaks (especially by blood-and-guts competitors). Most HLG designs will survive the launch as long as the tubing isn't stretched too far. Only pilots with ultralight, built-up planes need worry. The two-pole system is better than a one-pole system for those who are afraid that their plane will run into the pole during the launch.

Skip mounts the tow hook near his plane's nose, but you can mount it almost any-

NEW TAILPLANE AIRFOIL

The April '92 issue of *Technical Soaring* has an interesting article on a new, wind-tunnel-tested airfoil design for the tails of full-scale, standard-class, ASW-24 sailplanes. It's the DU 86-137/25 asymmetrical airfoil, and it may be a good choice for a model design. It has a 13.7 percent thickness and an elevator that's 25 percent of the chord of the horizontal tailplane. The elevator's operating range is between -15 degrees and +5 degrees.

In the plot, you can see the slight dip in the top surface, just before the elevator hinge line. Zigzag turbulators are an integral part of this design, and experiments determined the best position at 59 percent chord, both top and bottom. The airfoil's shape and the turbulators noticeably reduce the laminar separation bubble at 0 degrees or with positive elevator deflection.



A drawing of the DU 86-137/25 tailplane airfoil.

DU 86-137/25 Coordinates

Upper Surface		Lower Surface	
x/c %	y/c%	x/c%	y/c%
0.007	0.131	0.047	-0.301
0.138	0.578	0.294	-0.696
0.453	1.015	0.764	-1.091
0.964	1.457	1.435	-1.502
1.656	1.904	4.516	-2.770
2.524	2.349	7.410	-3.583
4.774	3.218	10.924	-4.348
7.677	4.039	14.994	-5.048
11.186	4.791	24.533	-6.151
15.249	5.448	29.857	-6.517
19.809	5.992	35.450	-6.736
25.805	6.411	41.232	-6.799
30.155	6.697	61.773	-5.691
35.786	6.844	70.167	-4.506
41.606	6.846	80.775	-2.457
44.559	6.790	90.121	-0.862
50.494	6.558	100.000	0.000
59.305	5.881		
65.012	5.168		
70.506	4.177		
76.229	2.984		
81.686	2.223		
90.745	1.084		
100.000	0.000		

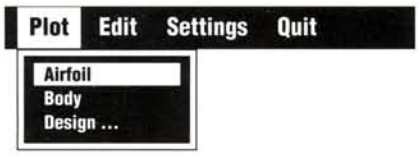
Because the ASW-24 has a T-tail, the airfoil's lower surface is conventional. This reduces flow problems at the juncture with the fin, where there's an interaction between the fin and the stabilizer airfoils. The author comments that, "Both test flights and actual practice with the ASW-24 have shown that the airfoil behaves very well, with ample reserve in difficult situations." I expect to see more airfoils designed to use artificial turbulation, but users will have to experiment with the location of the turbulator to achieve optimal performance.

where, including in the usual high-start/winch-mounting locations. (I prefer the forward-mounted hook.) Make sure that the tow ring can be slid off the hook easily; you don't need the excitement of having your glider bounce back at you.

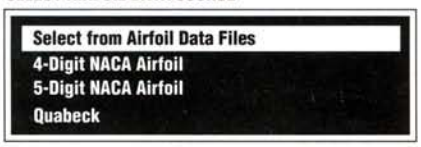
Using this launching system, faster HLGs have an advantage over light floaters because they can search for thermals over a larger area. My HLG original design with an SD-8000 airfoil isn't very good at hanging around, but it flies extremely well when launched by the catapult. It can also cover plenty of ground while searching for thermals.

Here's the catapult setup ready for launches at this year's SKSS contest. Rubber tubing is attached to both poles; a short tow line is attached to one end of the model and the other end is attached to the tubing. The system works just like a big slingshot.

Screen 1

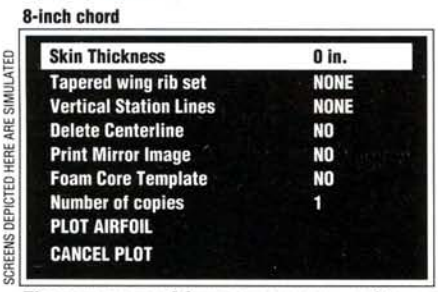


Screen 2



Screen 3

Screen 4



SCREENS DEPICTED HERE ARE SIMULATED

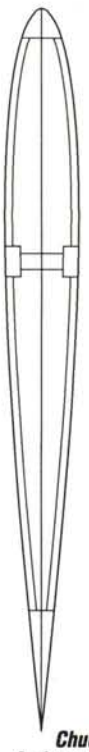
These menus and form screens are used to select and plot one foam-core rib template. You can use the keyboard or the mouse to make selections.

MODEL DESIGN PROGRAM V3.0

Chuck Anderson* recently released a 3.0 version (for IBM compatibles) of my favorite air-plotting program. In addition to the features of the original version, it has improved menus, mouse support, help screens and—my favorite upgrade—HP LaserJet printer drivers that enable you to create high-quality templates.

Chuck sells two volumes of sailplane airfoil data; together, they provide information on most modern airfoils, including all the SDs and many of the RGs. The disks in this impressive collection are real timesavers. I regularly use them to generate templates for foam wings or foam molds for shell construction.

The 3.0's new pull-down menus you can see on the screens really speed up selection. You can choose from airfoil data files or enter the parameters for the formulas for NACA and Quabeck airfoils. You can use the airfoil menu to plot foam-core templates. Just fill in the form with specific features such as skin thickness and reference lines. The program will generate station lines on airfoil plots that you can use as guides when you cut tapered cores.



Chuck Anderson's program was used to plot this built-up wing template.

The design part of the program is for conventional wing construction. With options for up to nine spars, sheeting and leading and trailing edges, you can plot a complete set of tapered-wing templates. You can even design a wing with one type of airfoil at its root and another type at its tip; the computer makes the necessary adjustments in between. For more information about this software, send Chuck a self-addressed, stamped envelope.

Here's the address that's pertinent to this article: **Chuck Anderson, P.O. Box 305, Pulla Homa, TN 37388.*

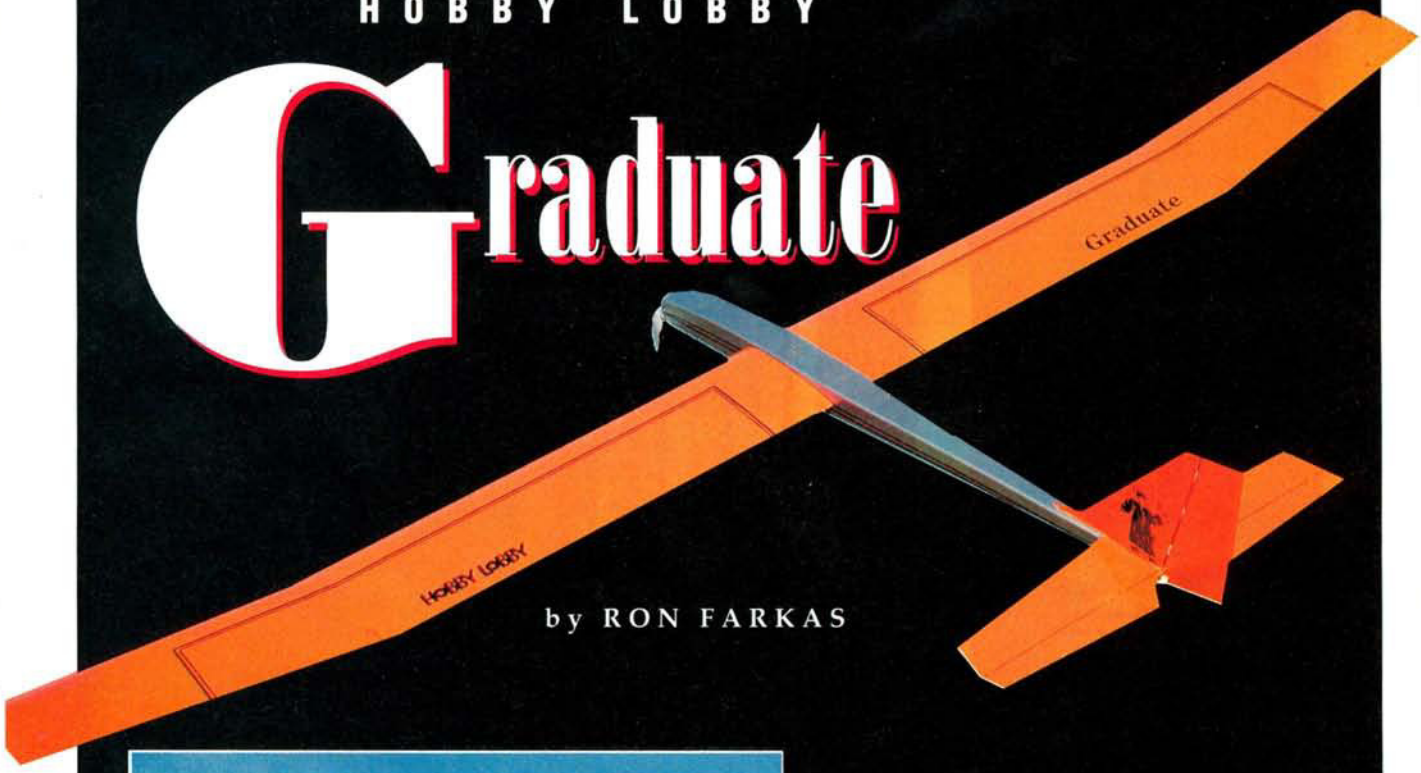
MODEL AIRPLANE NEWS MAGAZINE

FIELD & BENCH REVIEW

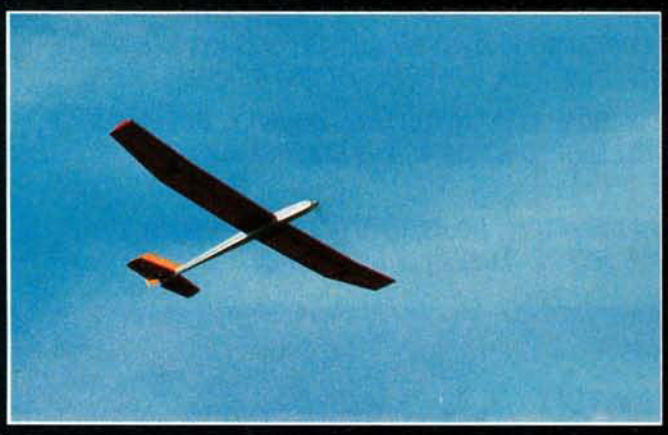
THIS ELECTRIC GLIDER GETS HIGH GRADES

THE HOBBY Lobby*/Premier Electro Graduate is an interesting model. With its 96-inch wingspan (ailerons are optional) and 05 motor, it fills the void between 2-meter, entry-level planes and high-performance soaring planes. This inexpensive, conventional plane has simple lines, a flat-bottom airfoil, straightforward built-up construction and a moderate performance envelope. The Graduate enhances thermal soaring performance and control authority without the usual increase in cost, sophistication and speed of the bigger ships with higher wing loadings.

HOBBY LOBBY Graduate



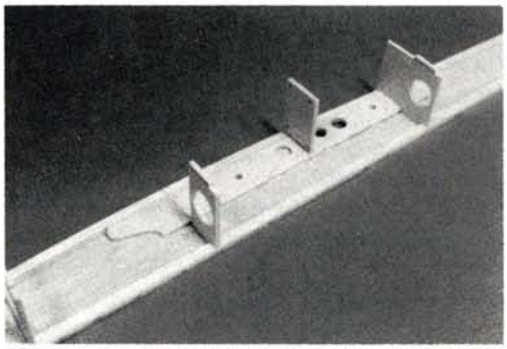
by RON FARKAS



Hobby Lobby sells the Graupner Speed 700 Turbo 9.6V ferrite magnet motor, the capacitors and a 10x6-inch folding prop for under $50. Although this motor requires an 8-cell battery pack and a suitable charger, it does represent a conservative growth path for someone who plans to fly electric regularly. (I suspect that a geared 05 cobalt on seven cells would suffice, but it would require some nose modification to mount it.)

PHOTOS BY RON FARKAS

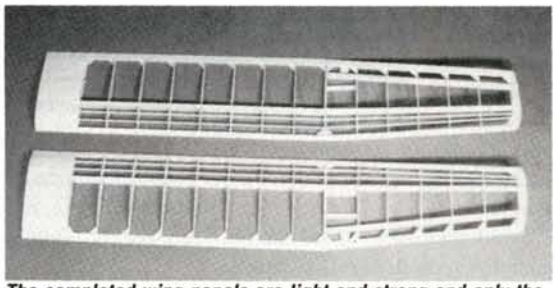
The Graduate can be built for electric power or as a non-powered glider. Imported from England, the instructions and some of the materials are different from what we're used to, e.g., all the steps refer to the parts by number instead of by name, and this can be annoying, because you must continually refer to the plan or the materials list. Fortunately, Hobby Lobby has included its own handy list, which cross-refers the part number, the name, the material and the size. All dimensions are in metric units, but the sizes are close to our system (e.g., a sheet that's 3mm thick is equivalent to 1/8 inch, and strip stock that's 910mm long is about 36 inches). The kit contains the typical 3mm lite-ply for the fuselage sides and an unusual 1.5mm two-ply variety for the top and bottom sheets. It proved to be a good substitute for the more common 1/16-inch balsa sheet.



After the main fuselage formers have been glued to one fuselage side, the other side is added. Make sure the formers are square with the sides.

CONSTRUCTION

To help speed things along, I enlarged the fold-out instruction sheet on a copy machine and wrote most of the part names near their respective steps. Construction goes quickly, and I used Carl Goldberg Models* Jet CA throughout the project.



The completed wing panels are light and strong and only the outboard panels have dihedral. Note the aileron servo rails at the dihedral joints.

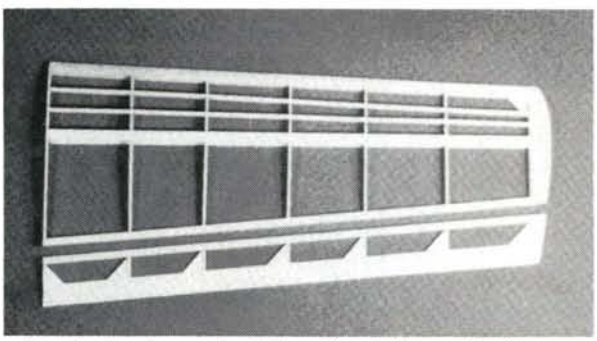
The wing ribs are die-cut, but you'll have to trim six of the main ribs for the center-section sheeting. For the main wing-panel construction, glue the ribs to the bottom sheet and the spruce spar, then add the shaped balsa leading and trailing edges. My leading-edge stock was quite warped, but the soft wood straightened out when I glued it to the ribs. The trailing-edge material was a little too thick, so I sanded it later to match the ribs. The top spars were added next. The balsa turbulator spars fit loosely in their notches, so I stripped replacements out of 1/8-inch-thick sheet. I completed the main panels by installing the shear webs, the wing-rod tubes and the top center-section sheeting. This design uses three 4mm (5/32-inch) wing rods rather than one with a large diameter.

I built the tapered outboard panels in a similar fashion. The aileron outline is shown on the plan but, since they're optional, you must slice them out and supply the balsa facing material and a servo-mounting arrangement. I turned the servo on its side and attached it to a 1/32-inch-thick ply plate that's screwed to a couple of rails between the ribs. I completed these steps before I joined the panels, although the instructions had it the other way around. With the ailerons, dihedral is cut in half by modifying the die-cut ply braces that fit beneath the top spar but aren't full depth. I didn't feel secure about removing material from the parts provided, so I made my own full-depth dihedral braces.

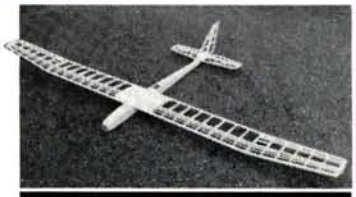
The horizontal and vertical tail surfaces were built-up from various widths of 6mm-thick (1/4-inch) strip stock. This above-average thickness is good for strength, and its weight is actually beneficial because it offsets the long nose moment.

The fuselage for the electric version is more complicated than that for the glider because of the installation of the motor, the battery compartment and the hatch. The fuselage instructions are adequate, but you'll have to read ahead for the electric conversion and then go back to the regular sequence.

The sides use longitudinal stringers, mid-section doublers and triangular-stock nose reinforcements. The fuselage width is sufficient for a 1200mAh sub-C flat pack with eight cells. The formers at the front and rear of the battery compartment were a little narrower than the top-view plan showed, so I replaced



The wing's outer panel with the optional aileron cut out.



SPECIFICATIONS

Model name: Electro Graduate
Manufacturer: Premier (imported by Hobby Lobby)
Type: Electric-powered sport sailplane
Price: Kit—$59; motor/prop—$48.70
Wingspan: 96 inches
Wing area: 800 square inches
Weight: 72 ounces; review model—67 ounces
Wing loading: 12 to 13 ounces per square foot
Length: 44 inches
Motor recommended: Graupner Speed 700 Turbo on 8 cells (approximately 120 watts)
Prop: Graupner 10x6-inch folding prop
No. of channels req'd: 3 or 4 (motor, elevator, rudder, optional ailerons)
Radio used: Futaba 7-channel 1024 FM
Airfoil: flat-bottom
Washout: No
Wing construction: Built-up rib and spar
Fuselage construction: Built-up, slab-sided
Features: built-up balsa wing and tail and light plywood fuselage construction. High-aspect-ratio wing with plug-in panels, flat-bottom airfoil and optional ailerons.

Hits

- An economical model of larger than average size, with good control authority, excellent light-air thermal ability and a broad speed range.

Misses

- The instructions are somewhat confusing owing to their format and the omission of part names from the text.

FLIGHT PERFORMANCE

This sweet-flying model has no bad habits. Flight times have been around 10 to 20 minutes in zero to moderate thermal activity, with a surprise 1-hour slope flight at the seashore.

• Takeoff and landing

The Graduate flies right away from a hand toss and climbs gently and steadily at about a 30-degree angle. It reaches thermal-seeking altitude in about 90 seconds. Like many powered gliders, a little right rudder trim at the transmitter helps keep it in a straight line while it climbs; then trim is taken out while gliding. Its gentle descent makes landings as simple as picking a heading and letting the model settle in.

• High-speed performance

It has a broad speed range for a lightly loaded model with a flat-bottom airfoil, and it also has good wind penetration, particularly when the nose is lowered to pick up speed. Directional stability is good at all speeds.

• Low-speed performance

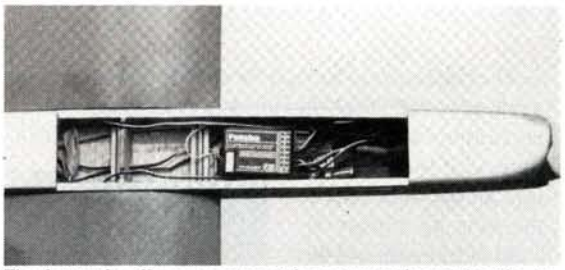
With the power off, the Graduate has a very flat glide. In calm conditions, it can move briskly with its nose level, or more sedately with its nose raised a little. A stall may occur at a very high angle of attack, but it's predictable, and there's a big safety margin. When a wing drops, the ailerons become ineffective, so the addition of some rudder correction will produce the quickest recovery on heading.

• Aerobatics

The ailerons aren't for aerobatics; they're used primarily to accomplish a quick and positive turn into a thermal and to control the bank angle while the plane is circling in the thermal. They're also used to level the wings on a landing approach. Either rudder or aileron alone will turn the model, but the smoothest, tightest turns are performed by coordinating both. For lazy sport flying, I programmed a 50-percent rudder mix on the aileron function, and I was pleased with the control authority. I imagine that the rudder-only version with additional dihedral would be suitable for beginners and many sport fliers, but ailerons provide better response for more demanding pilots.

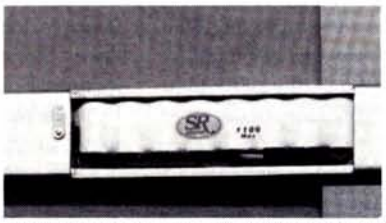
them to maintain a constant width throughout the fuselage midsection.

I discarded the supplied plastic-sheet top-hatch material in favor of 1/32-inch-thick ply, and I extended the hatch to provide access to the wing-retainer hooks. I chose 1/32-inch-thick ply for the bottom hatch, and I cut ventilation holes in it, since there's no other way for air to exit. In shaping the nose, I didn't try to match the spinner contour exactly because I'd have had to remove too much material.



The forward radio compartment is roomy and contains the receiver and the motor controller. The rudder and elevator servos are mounted aft of the wing.

I covered the fuselage with silver Top Flite* MonoKote and all of the flying surfaces with orange Hobby Lobby Oracover. I hinged the ailerons at the top surface with a strip of covering material. This will allow unrestricted upward movement if I want to mix aileron and spoiler functions later on.



The battery-compartment hatch beneath the fuselage is made of 1/32-inch-thick plywood. Shown is an 8-cell SR 1100mAh pack, but there's room for larger packs.

The Graduate didn't come with decals, so I had AMP Graphics* make a vinyl transfer from a picture of a young man in a cap and a gown. I also had a diploma, the Hobby Lobby logo and the rest of the lettering reproduced. These graphics and some pinstriping really set off the airframe's basic lines.

A Futaba* S-133 microservo is mounted in each wing for aileron control, with two more in the fuselage behind the wing for the the rudder and the elevator. The forward radio compartment easily holds a 7-channel Futaba receiver and a Graupner* Power Switch-25 on/off motor controller with BEC. (It could also hold a receiver battery if needed.) I use a programmable Futaba 1024 FM 7-channel transmitter. By the way, there's about 9 feet of servo wire in the airplane, and there have been no glitches.

My power battery is an 8-cell SR* 1100mAh Max Pack. This was chosen for its quality and 1100 capacity in a 900-size package. The Speed 700 Turbo 9.6V motor with 10x6 prop draws about 24 amps, so the total run time is about 3 minutes. My Graduate weighs 5 ounces less than the target weight, so I might put in a pack with a higher capacity.

There aren't many electric sailplanes available in this size, and probably none is in this low price range. Although the instructions leave something to be desired, it's an easy airframe to build. Considering its price and good flying qualities, it's a desirable airplane. Likewise, the 8-cell Speed 700 Turbo power system is a surprisingly good performer and well matched to this model. The review model received many favorable comments at the 1991 KRC Electric Fly-In, and I expect to get a lot of flying enjoyment from the Electro Graduate.

**Here are the addresses of the companies mentioned in this article:*

Hobby Lobby International, *5614 Franklin Pike Cir., Brentwood, TN 37027.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

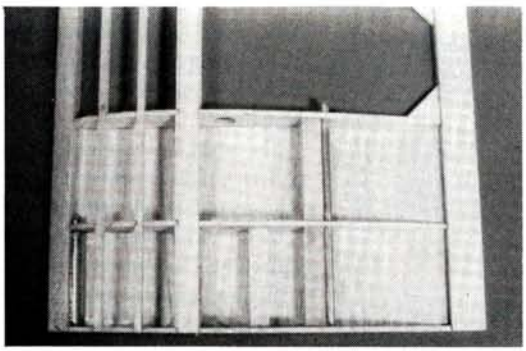
Top Flite Models, *2635 S. Wabash Ave., Chicago, IL 60616.*

AMP Graphics, *36 Park St., Blue Point, NY 11715.*

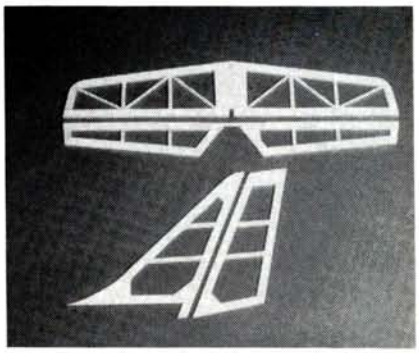
Futaba Corp. of America, *4 Studebaker, Irvine CA 92718.*

Graupner; *distributed by Hobby Lobby International.*

SR Batteries Inc., *P.O. Box 287, Bellport, NY 11713.*



The wing root has three brass tubes for the wing-joining rods. The center tube is sandwiched between the main spars, plus, hardwood bracing also increases strength.

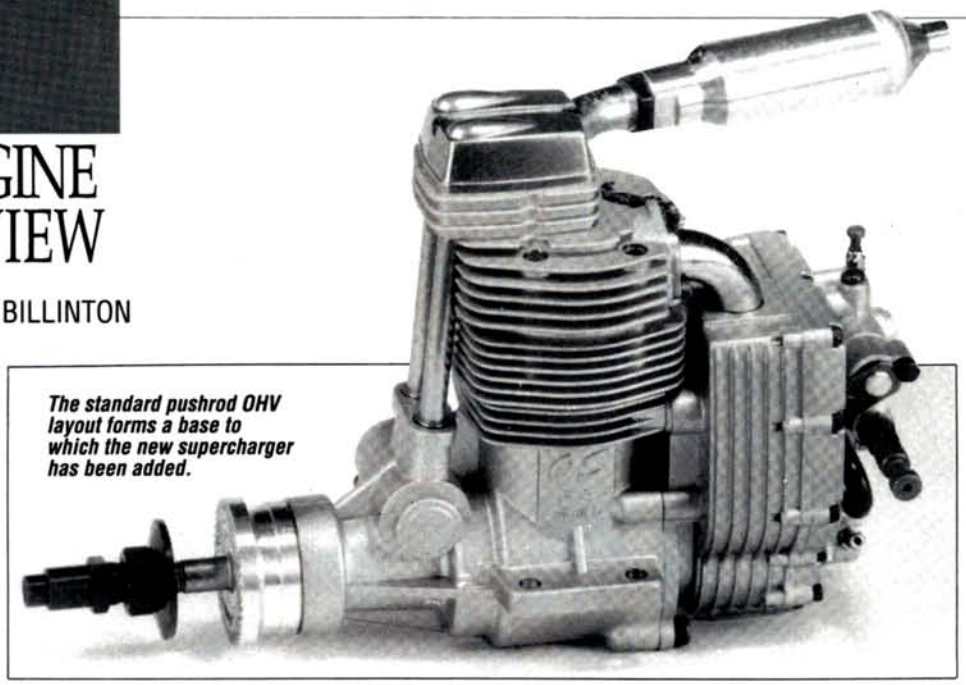


The built-up balsa tail surfaces are light and sturdy, and the fin post fits between the fuselage sides.

ENGINE REVIEW

OS FS-1.20 SURPASS SP

by MIKE BILLINTON



The standard pushrod OHV layout forms a base to which the new supercharger has been added.

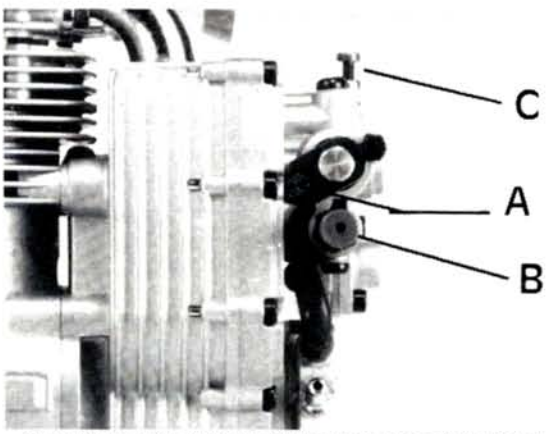
O.S. JAPAN HAS obviously realized that when one of its engine does well in a prestigious model event, its sales—and its profits—increase. The company's most recent top-of-the line offerings include the .21 RX-R car engine, the FAI Aerobatic Hanno Special .61 RF and the FS-120—a fearsome, unique, 20cc, supercharged 4-stroke tested for this review.

This superb engine was clearly intended to dent the YS 120's hold on the F3A pattern event, and it's a technical masterpiece. Setting it up and operating it will, however, daunt all but the most committed modelers. Fortunately, O.S. provides very comprehensive instructions that, if followed closely, guarantee a satisfactorily thunderous, supercharged performance. Right now, it's still a little early to assess its true potential in the air, but Hanno Prettner's fifth place in the November '91 World Championships is probably just a hint of what's to come.

Some years back, F3A engine regulations were amended to allow 20cc 4-strokes to compete against the traditional 10cc 2-strokes, and it's worth considering the consequences of this. At the time, the FAI recognized the considerable advantage held by the highly developed tuned-pipe 2-stroke, but it also saw that noise was becoming a problem. Now, both styles of engine are battling it out, and both operate less noisily (down at around 9,000rpm). Forced down to lower rpm, though, the 4-stroke's power advantage (YS 120: 2.3hp; FS-120: even more punchy) over the 2-stroke's 1.6hp doesn't seem to count for much. Because a 4-stroke produces noise at a lower, less abrasive frequency than a 2-stroke, it sounds quieter, even though the dB meter shows that it's just as noisy. It also offers nearly twice as much torque, but so far, that hasn't been enough to ensure its victory.

An engineering work of art

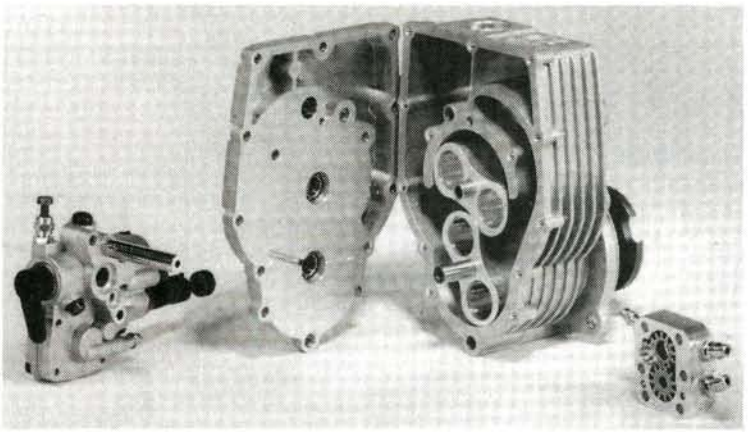
Having recently tested and operated the Webra .61F long-stroke (winner of recent World Champs), I still think the simplicity of the 2-stroke tuned-pipe unit will always appeal to competitors. Some will always think that the relative complexity of the impressive 4-stroke makes it more difficult to focus on flying. Others though, thrive on complexity; they'll be happy to put extra care and attention into the 4-stroke's installation, plumbing and operation. In other areas of technological advance, increased effectiveness often means increased complexity; why not in the area of model engines?



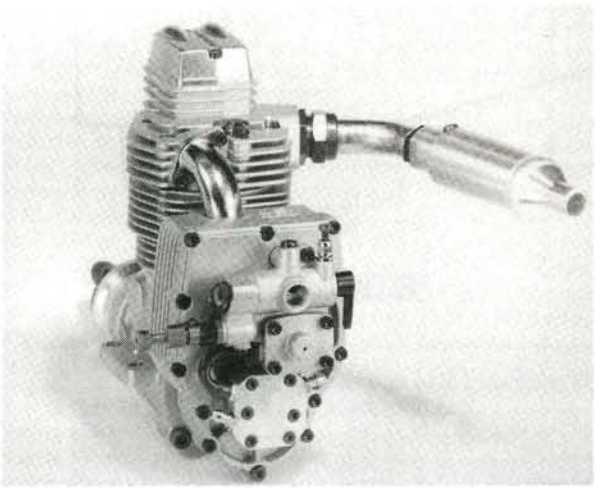
The adjustment screw for mid-range and idle mixture is at "A"; the main fuel needle is at "B"; the throttle stop is at "C."

MECHANICAL NOTES

Though most modelers could strip and rebuild the *usual* 2- or 4-stroke engine, O.S. says you'll reduce this one's performance if you do so. They probably advise against it because of the supercharger unit that's bolted onto the rear of what's otherwise a fairly standard O.S. 120 FS engine. The problem is sure to be the supercharger's very precise internal clearances, with which the engine overcomes the adverse "scale effect" of being a small engine. (Small engines have a small volume of air going through them, and this represents a low inertia that inhibits cylinder filling



The essence of this engine is the "Roots" blower. The rotating lobes and casing are fine achievements. The gear fuel pump is on the right, and the combined carb and fuel regulator is on the left. The long tube on the carb feeds supercharger pressure to it from idle to mid-throttle positions only.



Fuel from the tank enters the gear pump (right) and runs to the carburetor through tubing at the top left of the gear pump. The other nipple at bottom left is for the return of excess fuel to the tank. Note that very small carb (5.4mm)! A larger carb would pose problems at this stage of the engine's development.

while increasing the likelihood of air leakage.)

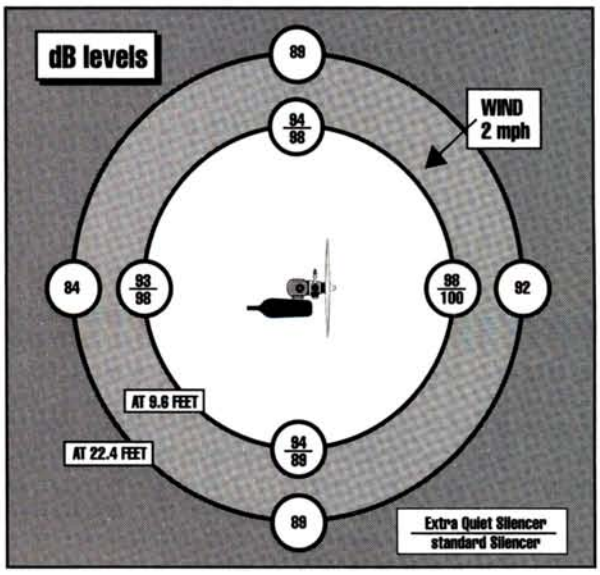
Even for full-size engines, the Roots-style twin-lobe or three-lobe blower must be perfectly machined. Doing this for a small 20cc engine must have been daunting. But, true to its reputation, O.S. persisted, and the result is a highly accurate "air pump," which, they emphasize should *not* be disassembled. If necessary, just send the complete unit back to O.S. for service.

Operated directly by the main crankpin, the auxiliary crankshaft rotates the lower of the two straight-cut Roots blower lobes. To move enough air from the carburetor through the blower and out into the inlet tract, the upper lobe meshes with the lower one at precise clearances. Obviously, the device operates at crankshaft speed. It *could* be redesigned and geared-up to rotate faster than the crankshaft, but that would give higher boost pressures, and there's already enough power to handle. To restrict rpm and prevent them from reaching levels that would exceed the engine's mechanical strength, the carburetor bore has been kept to 5mm. So far, no one has asked for increased performance, so the direct crank drive suits O.S.

The twin, spur-gear, fuel pump is also driven by the auxiliary crank. During tests, when operating at around 10,000rpm,

SOUND LEVELS—dB

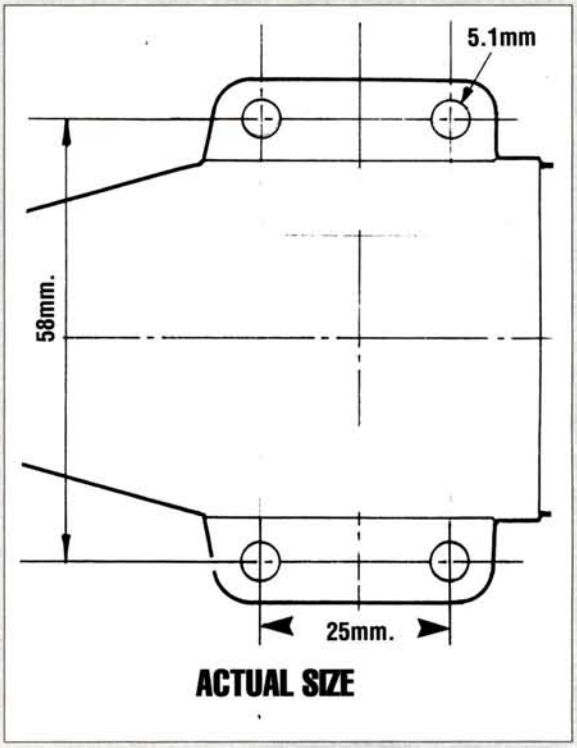
ENGINE ..... O.S. FS-120 SP (supercharged)
EQUIPMENT ..... Standard muffler and EX quiet muffler
FUEL ..... 20 percent nitro
TEMPERATURE ..... 46°F.
HUMIDITY ..... 82 percent
PROPELLER ..... 14x14 APC
MEAN RPM 8,600
ENGINE POSITION ..... 3 feet, 2 inches above ground
SOUND METER ..... Class 2 Castle CS182B unit with GA601Calibrator set to NPL standard. Meter set at 3 feet above ground and pointing directly at nearest sound, i.e., prop, or EX muffler outlet, etc. Sound levels were measured at 3 meters (FAI) and at 7 meters (BMFA Domestic).
METER SETTINGS ..... "A" scale and "slow" response



SPECIFICATIONS

WEIGHTS & DIMENSIONS

Capacity	1.2198ci (19.9897cc)
Bore	1.197 inch (30.4mm)
Stroke	1.084 inch (27.53mm)
Stroke/bore ratio	0.9056/1
Timing periods	Exhaust - Opens - 82° ATDC Closes - 40° ATDC; total period = 318° Inlet - Opens - 58° BTDC Closes - 68° ABDC Total period = 306° Overlap - 98°
Valve clearance	0.002 inch (0.051mm)
Combustion volume	3.2cc
Compression ratios	Geometric - 7.246:1
Cylinder-head squish	0.090 inch (2.29mm)
Squish-band width	0.150 inch (3.81mm)
Carburetor bore	5.4mm
Crankshaft diameter	0.5905 inch (15mm)
Crankshaft bore	0.414 inch (10.54mm)
Crankpin diameter	0.3145 inch (8mm)
Crankshaft nose thread	0.309 inchx24 TPI (5/16 UNF)
Wristpin diameter	0.287 inch (7.30mm nominal)
Connecting-rod centers	1.692 inches (43mm)
Engine height	5.43 inches (138mm)
Width	2.64 inches (67mm)
Length	6.18 inches (157mm—prop driver to rear of charger)
Width between bearers	1.84 inches (46.8mm)
Mounting-hole dimensions	2.28x0.984 inches (58x25x5mm)
Frontal area	10.6 square inches
Weight	Bare - 2 pounds, 4 1/2 ounces (1,037g) With muffler - 2 pounds, 6 ounces (1,080g.)
Crankshaft weight:	4.85 ounces (137g.)
Piston weight:	0.45 ounce (14g.)
Performance:	
Max. b.hp	3.02 @ 11,880rpm (standard muffler/20% nitro) 2.97 @ 11,600rpm (open exhaust/20% nitro) 2.78 @ 11,765rpm (EX muffler/20% nitro)
Max. torque:	300 oz./in. @ 8,464rpm (open exhaust/20% nitro) 296 oz./in. @ 8,333rpm (standard muffler/20% nitro) 287 oz./in. @ 8,263rpm (EX muffler/20% nitro)



ACTUAL SIZE

RPM on standard fixed-wing propellers:

	Open exhaust	Std. muffler	EX muffler
18x8 Top Flite	7,545	7,447	7,432
14x14 APC	8,873	8,761	8,721
15x8 Graupner	10,107	9,923	9,930
13x10.5 MK fiberglass	11,023	10,926	10,812
14x8 APC	11,628	11,470	11,443
12x12 APC	11,700	11,420	11,369

Performance equivalents:

b.hp/cubic inch	0.151
b.hp/cc	2.47
Ounce inch/cubic inch	15
Ounce inch/cc	246
Ounce inch/pound	131.5
Gram meter/cc	10.7
b.hp/pound	1.32
b.hp/kilo	2.91
b.hp/square-inch frontal area	0.28

Manufacturer: O.S. Engines, Osaka, Japan. U.S. Distributor: Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

the fuel pressure measured approximately 3psi. The fuel is delivered at that pressure to the fuel-pressure regulator that's mounted above the pump. The regulator releases fuel to the carburetor in response to need, which is determined by rpm and throttle opening. If too much fuel is supplied, it's returned unused to the fuel tank, and there *is* a considerable flow along this return line!

Like the blower, the fuel pump and regulator should *not* be dismantled. Also, O.S. has constructed a complicated, very precise engine, and if you want trouble-free long-term running, you owe it to them to ensure that the fuel the parts receive is as clean as possible. Don't ignore O.S.'s suggestion that you use high-quality filtration.

Hanging on the front of the impressive blower and fuel-delivery system is an almost standard O.S. 120 4-stroke engine. Note, however, that the inlet valve is large (14.2mm) in comparison with the exhaust-valve (diameter 12.2mm). The fairly radical valve-timing setup gives almost 100 degrees of overlap between the point at which the inlet valve first opens as the piston rises toward top dead center and the point at which the exhaust valve finally closes as the piston descends. Meanwhile, the blower continues to pump fuel and air through the inlet valve and into the cylinder. Apart from anything else, this clears any remaining exhaust products out of the cylinder more effectively than is usual with an engine that isn't supercharged. This isn't

Like most model 4-strokes, the FS-120 uses a one-piece phosphor-bronze plug, from which the valve guide and seat are machined. The large (14mm) inlet valve is on the right.

without risk, though; positive blower pressure might force unburnt fuel out through the exhaust valve, and that would mean a wasteful increase in fuel consumption. The exhaust valve's final closure point is therefore a significant feature of this engine's design.

O.S. anticipated that supercharging would lead to high cylinder pressures. To avoid this, they gave the engine a large combustion volume of 3.2cc, which results in a low geometric compression ratio of 7.2:1. Published figures suggest that, at moderate pressures (around 10psi), this would increase to an effective compression ratio of almost 9:1. The same source suggests that, at this degree of boost, power would be at least 40 percent greater than it would be in an engine that isn't supercharged. Supercharger pressures measured during this test gave power increases much in line with these predictions.

Finally, the supercharger's superbly refined design and layout have resulted in a low overall weight of only 36^1/2 ounces, and this gives the highest (so far) model 4-stroke power-to-weight ratio of 1.32hp per pound. This engine's other "highs" are a torque/capacity ratio of 15 ounce/ inches/ cc and an unsurpassed BMEP (brake mean effective pressure) of 196.

RUNNING IN AND HANDLING

Given the engine's expected high power and the usual insufficiency of oil in the lower crankcase, the bronze-bushed big end is under more pressure than usual, so run-in must be approached cautiously. The engine doesn't have an ABC setup (it has a nickel-silicon-plated ferrous liner), but O.S. has confidently covered all bases by using high-quality materials and construction methods.

The instructions advise:

"All internal-combustion engines benefit, to some degree, from extra care when they're run for the first few times—running-in or breaking-in. O.S. engines, however, are made with the finest modern precision machinery and from the best and most suitable materials, so only a very brief break-in period is required, and this can be completed with the engine installed in the model."

The instructions go on to define how and for how long the FS-120 should be run-in. Broadly speaking, they advise a very short initial burst followed by alternating fast and slow runs of increasing lengths. The very first few cycles are supremely important. Given the engine's fine construction and materials, performance improves rapidly.

The recent trend toward the use of small, quieter, high-pitch propellers helps with run-in because during that period, rpm should be somewhat restricted. Nothing is worse for any engine than to be run the very first time with a large, heavy prop (to keep rpm down). Not only does this place the greatest stress on bearing surfaces, but a heavy prop's inertia can also obscure signs of engine distress, if any, during run-in. A smaller, low-weight/low-inertia prop is ideal. To keep rpm down, use a rich mixture, not a heavy prop.

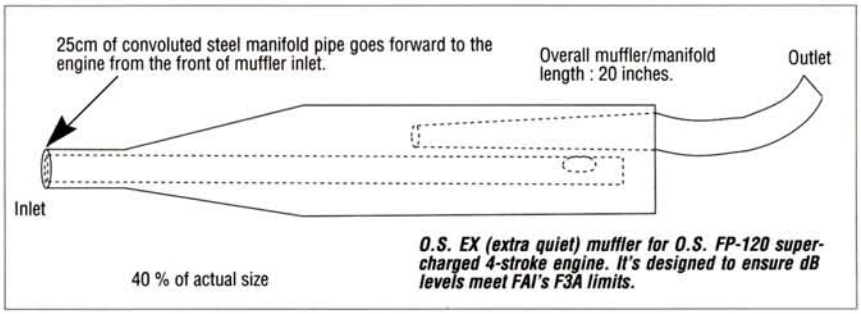
During run-in, this supercharged engine responds relatively slowly to fuel-needle movements, so start with a rich setting and make only *small* adjustments. Wait 5 seconds or so to assess the difference in engine speed; there's quite a lot going on at the back there, so give it all time to react!

When you've reached a slightly rich setting and completed run-in, you'll find that throttle response is super-swift. Throughout the tests, the mixture-control screw for mid-range and idle settings showed the same delayed response as the main needle.

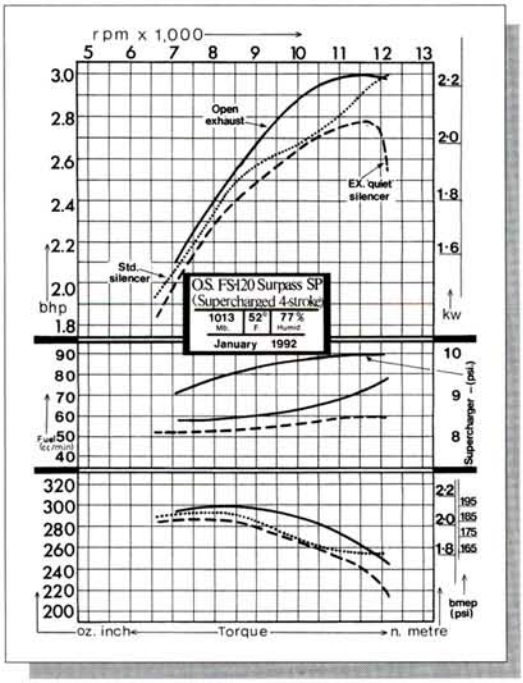
As always, *avoid over-lean settings*. If you use heavier-than-average props, any weakening of the mixture settings will soon show up as detonation and "backfiring," which will rapidly loosen props. But this is a very damaging way to assess a mixture's leanness. It's always far better to monitor that rpm are increasing while the needle is slowly closed *from the rich side*.

To some extent, this engine stretches the glow-plug mechanism to the limits. The fear of detonation at low-rpm/heavy

(Continued on page 96)



O.S. EX (extra quiet) muffler for O.S. FP-120 supercharged 4-stroke engine. It's designed to ensure dB levels meet FAI's F3A limits.



WHIZPURR

(Continued from page 17)

ailerons were fluttering. I added the counterbalances as shown on the plans, and I haven't encountered any problems since. With any motor other than the 40 FAI, the balances are unnecessary.

I incorporated a separate compartment in the design for the motor batteries. It's also an air duct to allow proper cooling. I purchased a Radio Shack 12V, 3-inch fan that I wired to long leads and battery clips. Whenever I land the airplane, I immediately remove the nose-hatch cover and place the fan on top of the fuselage so that it can cool the hot motor batteries.

The Whizpurr 40 has been flown by several expert pilots who were asked to wring it out. The plane hasn't been stumped yet, but its natural stability doesn't allow it to spin well. I'd appreciate comments from anyone who builds this airplane. My address is 84 Goldenrod Ave., Bridgeport, CT 06606.

**Here are the addresses of the companies mentioned in this article:*

***Astro Flight Inc.**, 1311 Beach Ave., Marina Del Rey, CA 90292.*

(Continued on page 83)

HOW TO

Painting heli canopies

PART III

Finishing touches

by RICHARD MUISE

Last month, I showed you how to make your canopy unique by spraying on some color. Now it's time to assemble the unit and add the scale finishing touches.

Run a fairly thick bead of Zap-a-Dap-a-Goo* along the leading and lower edges of one—and only one—canopy half. (If the edges are more than 1/2 an inch wide, trim them before you apply the adhesive.) Join the halves, check that they're aligned properly, and clamp them together with "bulldog" clips or clamp-type clothespins. Let the adhesive dry for at least 24 hours. (Note: Zap-a-Dap-a-Goo won't harm the canopy's exterior; if you spill some, just wipe it off.)

After the canopy has dried thoroughly, use Lexan scissors to trim the seam so that it's about 1/4 inch wide.

Block-sand (use 220-grit paper) or file the edge of the seam to give it a smooth, finished appearance.

Hel-X* protects the canopy's exterior with a nearly invisible covering. To remove it, pick at an edge of it with a hobby knife.

PHOTOS BY PAUL SCHWARTZ

Here's the finished canopy—complete with stickers—ready to be mounted. (Note: use Zap-a-Dap-a-Goo to attach things to the canopy's interior; other types of adhesive will damage painted surfaces.)

If you've read all the articles in this series and this project still seems like more work than you want to tackle, you can order a custom-painted canopy from Motion Graphics* or Hel-X. There are many styles and designs from which to choose.

**Here are the addresses of the companies mentioned in this article:*
***Zap-a-Dap-a-Goo**; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.*
***Hel-X Corp.**, 558 Highland Ave., Upper Montclair, NJ 07043.*
***Motion Graphics**, 2645 Robert Arthur Rd., Westminster, MD 21158.* ■

WHIZPURR

(Continued from page 78)

***Zinger**; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, VA 90710.*
***MonoKote**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***Sig Mfg. Co.**, 401 Front St., Montezuma, IA 50171.*
***Jomar**, 2028 Knightsbridge Dr., Cincinnati, OH 45244.*
***Hallco**, 420 E. Water St., Urbana, OH 43078.*
***Du-Bro Products Inc.**, 480 Bonner Rd., Wauconda, IL 60084.*

TOP GUN

(Continued from page 39)

with giant, smoke-belching Lanier Stingers that was memorable for sheer guts and bravado.

HISTORY WAS MADE

For the technology-minded, the most striking exhibition flights were powered by the new JPX* Turborec T240 turbine jet engine. Jack Buchoux and his colleagues from Vibraye France have developed this engine over a period of years. (It's available from JPX, delivered to your doorstep in the U.S., for approximately $1,500.) The turbine was mounted in an F-16 and a Byron F-20, and each flew for several minutes on about a pound of liquid propane. Pressure from a line to a scuba tank was used to spin up the turbine, which was then ignited using spark ignition. The sound created by this turbine (approximately 72dBa in flight) has the unmistakable, authentic, high-pitched "swish" of a full-scale jet engine. The planes flown appeared to be early, stripped-down prototypes. (The F-16 didn't have retracts, and both used elevons instead of ailerons.)

The T240 includes an electronic metering unit that delivers measured quantities of liquid propane to the turbine. A single rotor in the combustion chamber spins up to 120,000rpm in flight, producing nearly 9 pounds of thrust. The unit weighs just under 4 pounds, less the fuel and oil

(Continued on page 94)

HOW TO

Build A Handy TRANSMITTER STAND

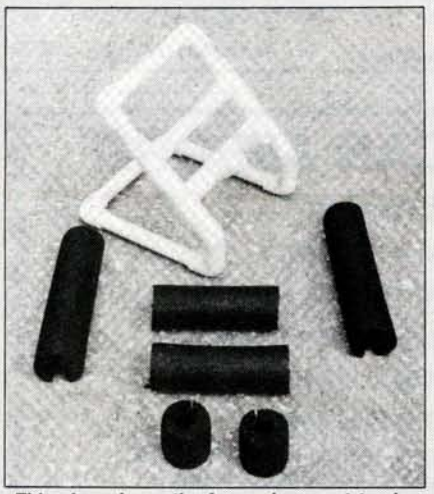
by CHARLES D. EVANS

A Pro-Line Ace, single-stick radio sits comfortably in the transmitter stand.

WHEN I SAW that my transmitters were showing excess stress and strain on their cases, I recognized the need for a portable transmitter stand that would help protect them from dirt, sand, wet grass and other hazards at the flying field. Not having any particular stand in mind, but having a surplus of PVC pipe and fittings (which remained from the installation of my lawn sprinkling system), I set forth to create a PVC transmitter stand. The stand worked out well; it's simple to build, costs little and eliminates concern about leaning your transmitter against your flight box or other equipment while it's not in use and not in an impound.

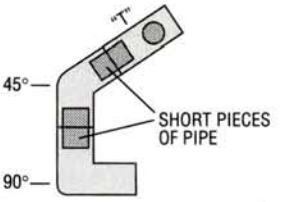
MATERIALS

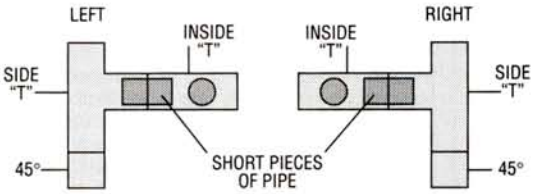
- 10-foot section of 1/2-inch PVC pipe
- Two, 45-degree, 1/2-inch couplings
- Six 90-degree 1/2-inch elbows
- Six, 1/2-inch, "T" couplings
- Two, 1/2-inch endcaps
- Small can PVC cement
- Sleeve of PVC foam insulation



This view shows the foam pieces cut to size. Notice that they've been slit so that they can be fitted to the stand.

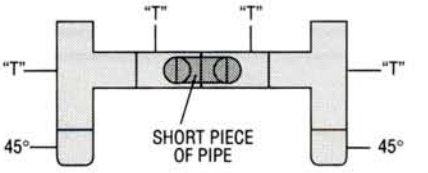
1 *All pipes and fittings are 1/2 inch. Glue as per sketch using short pieces of pipe so that the three couplings are end to end. Make one left-hand and one right-hand assembly. Be sure the T is 90 degrees to the 45-degree coupling and that the assembly is perfectly flat.*

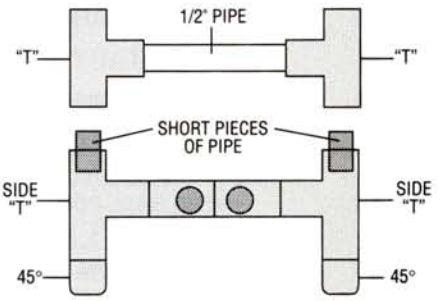




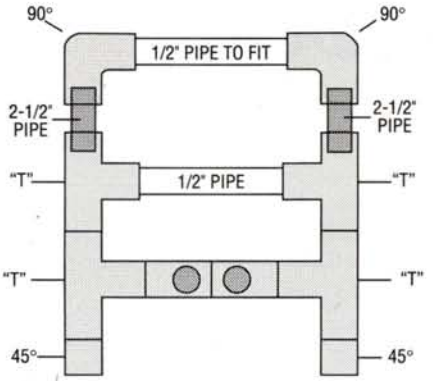
2 *Glue the inside Ts to form the first crosspiece (use short pieces of 1/2-inch pipe) to the side assembly T. Do this for both the right-hand and left-hand sides.*

3 *Join the two sides with a short piece of pipe so that both inside crosspiece Ts touch each other. Keep the assembly straight and level in relationship to the 90-degree elbows.*

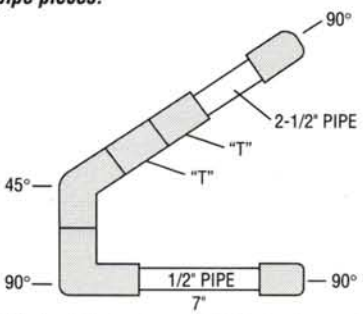




4 *Glue short pieces of pipe into the side Ts on both sides. Assemble (but don't glue) two more Ts on these short pieces of pipe. Cut a piece of 1/2-inch pipe to fit between these two newly mounted Ts. Use the assembled Ts to measure the length of this 1/2-inch pipe. Disassemble the Ts, and glue the pipe into the Ts making sure everything is square and level.*



5 *Cut two pieces of pipe 2 1/2 inches long and glue into top Ts on both left and right sides. Assemble (don't glue) the 90-degree elbows to the 2 1/2-inch pieces of pipe. Cut a piece of 1/2-inch pipe to fit between the two 90-degree elbows. As in all PVC construction, the pipe must mate inside the couplers. Disassemble the elbows, and glue the pipe and elbows into an assembly keeping everything straight and level. Glue the elbow/pipe assembly to the 2 1/2-inch pipe pieces.*



6 *Cut two 7-inch pieces of 1/2-inch pipe, and glue into the 90-degree elbows on the forward bottom of the stand. Assemble (but don't glue) two 90-degree elbows to a 7-inch piece of pipe. Cut a piece of 1/2-inch pipe to fit between the two 90-degree elbows. Disassemble the elbows, and glue the pipe between the elbows; ensure that the assembly is straight and level. Glue this assembly to the 7x 1/2-inch pipes that form the base.*

A Cirrus PCM transmitter rests in the PVC transmitter stand.

7 *Cut two short pieces of 1/2-inch pipe, and glue them into the two remaining openings in the Ts on the first crosspiece. Add the two endcaps to complete your transmitter stand.*

8 *Cut the foam sleeve to fit the stops, the side pieces and the crosspieces. It will be necessary to slit the foam sleeve to attach it to the stand.*

It took a total of two hours to build the first stand. I'm sure it will be much easier to assemble the next one. Enjoy!

ROTARY-WING ROUNDUP

NEW HELI PRODUCTS

GREAT PLANES MODEL DISTRIBUTORS
Kyosho Concept 10

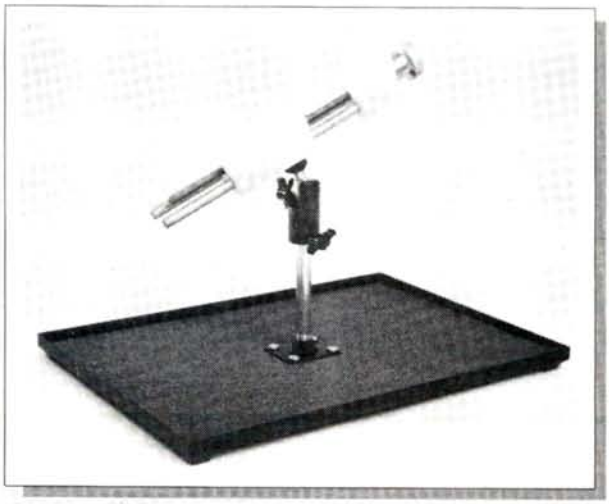
The new Concept 10 is a small, gas-powered heli that's perfect for fliers who prefer compact machines like the EP Concept, but demand more power and longer flight times.

Approximately 50 percent of the Concept 10 parts are compatible with the EP Concept. The same type of rotor blades is used for both helis, although the blades on the Concept 10 are slightly longer. It's 80-percent assembled, the engine and the muffler are installed, and it uses a convenient recoil pull-start. Specifications: length—39.9 inches; main rotor diameter—38.2 inches; height—11.2 inches; weight—3.1 pounds.

Part no. KYOE0235

Price: $549.95

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.



SMC LIGHTNING PRODUCTS
Steady Lift, Jr.

SMC Lightning Products recently upgraded its standard Steady Lift, Jr. Workstation. It's now equipped with a 4-inch threaded stud, which increases the height of the clamping mechanism by 2 inches, so that an R/C model can be tilted or rotated to make it more accessible.

SMC Lightning Products, P.O. Box 1607, Tomball, TX; (800) 527-1079.

GRC PUBLICATIONS
Hirobo Shuttle Z/ZX Book

Make your Hirobo Shuttle Z/ZX even better! This book, which is specifically about the Shuttle Z/ZX RC, is packed with tips for the novice, and it includes pitch-curve settings for different situations. You can find out how to convert your Shuttle Z to a Shuttle ZX, make it more durable and stable, and enhance its aerobatic capabilities and its looks. Also included are setup and repair tips.

Price: $6.95

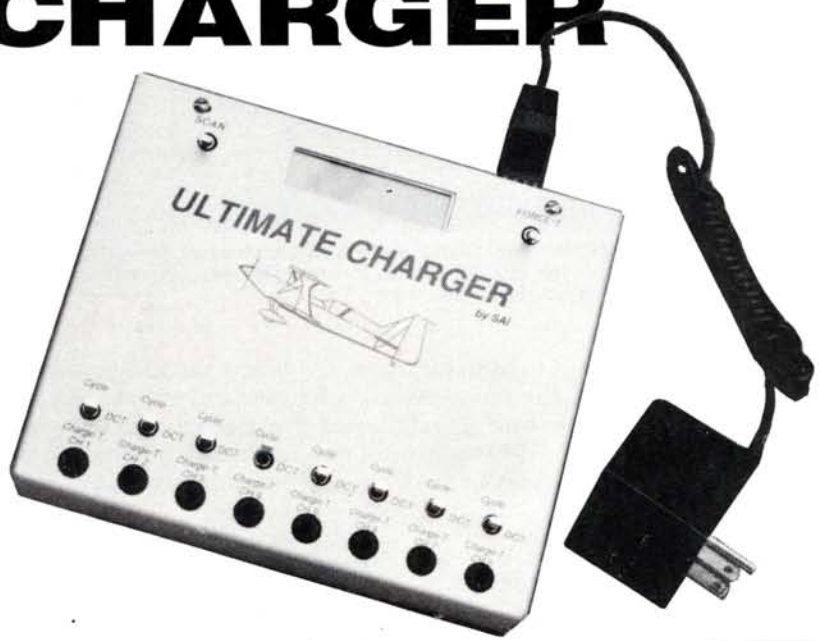
GRC Publications, 6 Londonderry Commons, Ste. 230-P, Londonderry, NH 03053.

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor guarantee product performance or safety.

SAI

ULTIMATE CHARGER

by MICHAEL MAYES



Simple, computerized battery maintenance

THE ULTIMATE Charger, available from SAI*, was designed and developed by Dr. Robert Suding. This device is more than a charger; it's a sophisticated, microprocessor-controlled battery-maintenance system that can charge, cycle, test and maintain up to eight Ni-Cd battery packs simultaneously. The 8749H microprocessor is the nerve center that controls all of the functions and the sequence of events as they happen. Future changes can be made by replacing the current microprocessor with a newly programmed one. Dr. Suding obviously put a lot of thought into the design of the Ultimate Charger.

BATTERIES

Before we get too involved with the charger, let's take a look at the Ni-Cd batteries used in R/C systems. Ni-Cds have several qualities that make them useful in R/C systems: size, weight, durability and cost. Other characteristics, however, include an unpredictable time-to-failure, a tendency to develop "memory" under certain conditions (although this seems to be less true of the new technology) and a tendency to occasionally develop internal shorts and/or opens. To reduce the chance of incurring battery failures, Ni-Cds should be regularly cycled, i.e., charged and discharged under controlled conditions, according to their manufacturers' specifications. The batteries should be frequently evaluated to determine any loss of capacity.

OPTIONS

Before using the Ultimate Charger, you must first determine the following: the number of channels needed to charge

SPECIFICATIONS

Item: Ultimate Charger
Purpose: Battery-maintenance system
Input Voltage: 120V AC @ 60Hz
No. of cells: 1, 4, 5, or 8
Display: 16 character, 1-line LCD
No. of output channels: 8
Battery capacity: 270mAh to 2200mAH
Discharge rate: 160mA
Dimensions: 7.5x6.5x2 inches (without leads)
List price: $189.95 + $10 S&H

FIGURE 1

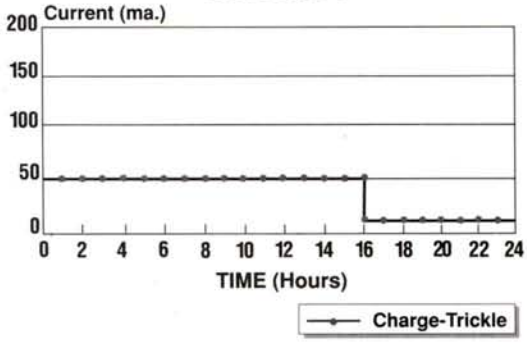
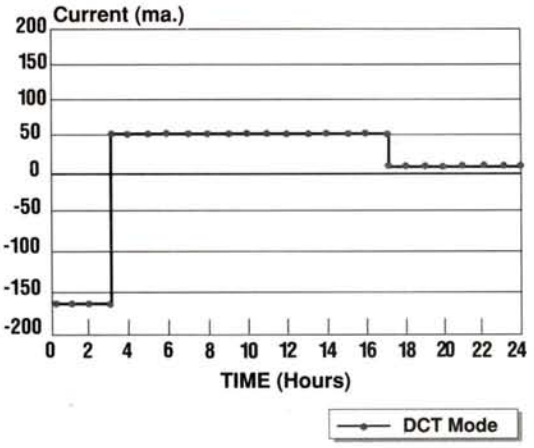


FIGURE 2



transmitter batteries, the capacity of each transmitter pack, the number of channels required to charge receiver batteries, and the capacity of each receiver pack. Once you've done this, you can set the 10 dip switches inside the case. These switches can be accessed through a rectangular hole in the bottom of the case.

DISPLAY

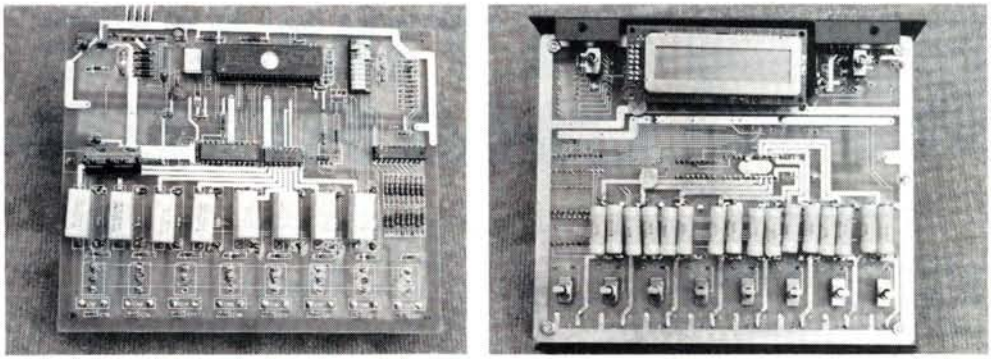
The Ultimate Charger has a one-line, 16-character LCD display that provides the following information: current; voltage; function status; cycle time; channel-select indicator; and battery capacity. In addition, it constantly checks the packs and gives a warning on the display if a shorted cell or an open pack is detected.

OPERATION

Each of the eight channels has its own mode-select switch that's independent of the other channels and has three positions: charge/trickle, discharge/charge/trickle and cycle. The Ultimate Charger is designed to discharge only one channel at a time. If more than one channel is programmed to be discharged, a queue is formed for the discharge function. The queue function is used to limit the thermal loading and to prevent the discharge IC from becoming over-stressed.

CHARGE/TRICKLE MODE

The charge/trickle mode (switch down) is the normal operating mode. As you can see in Figure 1, the Ultimate Charger charges the batteries at a C/10 rate (50mA for a 500mAH pack) for 16 hours, then it automatically switches to a C/40 rate (12.5mA for a 500mAH pack). The C/40 (or trickle) charge rate isn't designed to charge the batteries; it's designed to maintain the charge until you're ready to use them. While in the charge sequence, the channel number, voltage and elapsed time (0 to15 hours) are shown on the display. The letter C stands for "charge" and a blinking "S" means a shorted cell has been detected. In the trickle sequence, the display shows the channel number, voltage and elapsed time (0 to 9999 hours), and the letter T stands for trickle-charge and an "S" means a shorted cell has been detected.



PHOTOS BY MICHAEL MAYES

■ *Left:the bottom side of the circuit board shows its simple design. Dip switches used for programming are at the upper right.* ■ *Right: with the cover removed, you can see the eight mode switches and the battery-lead terminal points just below each switch.*

DISCHARGE/CHARGE/TRICKLE MODE

The discharge/charge/trickle mode (middle switch position) is a single-cycle mode that prevents your batteries from developing a memory. As you can see in Figure 2, the Ultimate Charger first discharges the battery pack at a discharge rate of 160mA. When the battery pack reaches a threshold voltage of 1.1 volts per cell, the charger automatically switches into the charge sequence. In this sequence, the battery pack is charged at a C/10 rate for 16 hours; then it automatically switches to a C/40 rate. While in the discharge sequence, the channel number, voltage, elapsed time in minutes and the letter D for "discharge" are displayed. The displays for the charge and trickle sequences are the same as described in the charge/trickle mode.

FIGURE 3A

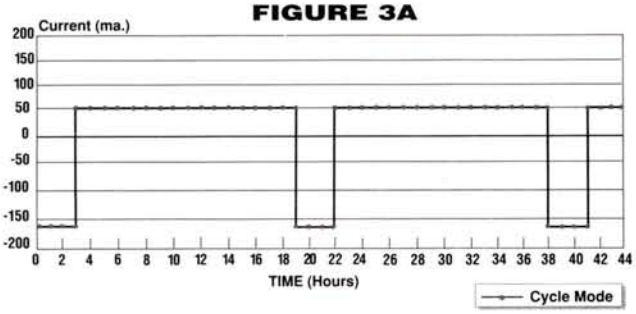
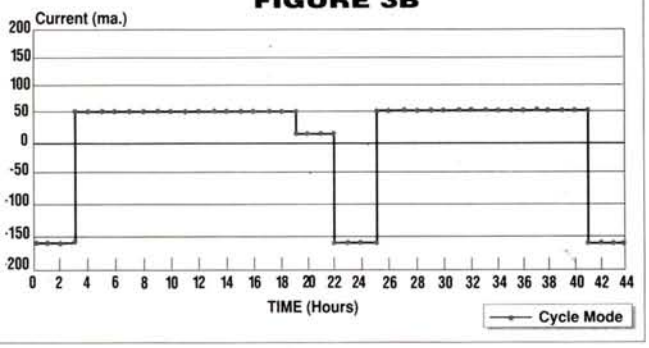


FIGURE 3B



CYCLE MODE

The cycle mode (upper switch position) is a continuous-cycle mode that automatically calculates battery-pack capacity and/or removes a memory that may have developed in a battery pack. As you can see in Figure 3A, the Ultimate Charger will first discharge the battery pack at a constant-current discharge rate of 160mA. When the battery pack reaches a threshold voltage of 1.1 volts per cell, the charger automatically switches into the charge sequence, and it calculates and displays the channel number, mAh rating and elapsed time (0 to 15 hours). This is the time that the battery has been on charge. In this charge sequence, the battery pack is charged at a C/10 rate for 16 hours. If no other channels are programmed in a discharge queue, then the discharge/charge cycle is repeated continuously. If other channels are waiting to be discharged, this channel will automatically change to a trickle sequence (see Figure 3B) until the queue has been completed.

OTHER FEATURES

The Ultimate Charger is normally programmed to scan and display all eight channels sequentially at 2-second intervals. Using the scan switch on the left of the display, you can select the display you wish to monitor and continuously display that channel. The Force-T switch is used to force any channel to go immediately into the trickle mode. With this switch (located to the right of the dis-

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TOP GUN

(Continued from page 83)

tanks. It's recommended for 13- to 16-pound aircraft. The insides of the tail pipes of the demo airplanes were clad with thin aluminum to protect the plane from the heat of the exhaust (1,166 degrees F). How long will one of these beauties last? Jack said after 20 to 40 hours of total run time, the bearings will have to be replaced. The engine's life includes many such bearing changes.

Seeing this turbine fly was a historic moment in the development of R/C technology. The price of the engine is already competitive with some of the larger specialty reciprocating engines, but Jack says the price will drop as orders increase (several tens of units have been sold). We'll bring you more on this subject as information becomes available.

THANKS

Many deserve thanks for helping to make Top Gun '92 possible. These include Frank Tiano, the indefatigable organizer; Herschel Worthy of Pacer Technology (thank you, Pacer!); UPS, who provided transport for the British contingent and their planes; the judges who gave generously of their time to ensure the contest would be as fair as possible; Sam Wright and David Platt, who again regaled the event with nonstop aviation banter; the Palm Beach Aero Club; and the host of supporting sponsors who generously provided products and cash for Top Gun awards. If you have a chance to visit the next Top Gun, don't miss it!

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TOP GUN

(Continued from page 94)

MAJOR SPONSORS

Pacer Technology: cash, hats, glue kits, trophies and judges' airfare
Model Airplane News: cash, shirts, magazines, trophies and judges' rooms

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ACE R/C: 8-channel computer radio
Airtronics: 8-channel Vision radio and carrying case
Bob Violett Models: $300 gift certificate
Dave Platt Models: FW-190 kit and one complete set of retracts
Frank Tiano Enterprises: cash, trophies and knife sets for all
Futaba: 9-channel PCM, 6-channel FM and Acrostar ARF kit
Gene Barton Machine: Sea Fury and Corsair custom wheels
Hobby Dynamics: JR-347 radio and Webra 120 speed engine
House of Balsa: Best Jet trophy, Tuffgrinds for all
Lanier R/C: Stinger kit and 3 ARF kits
McDaniel R/C: 12 nystarters and two on-board ignition systems
R/C Report: cash, subscriptions and Best Biplane trophy
Robart Mfg.: cash and engineering excellence trophy
Sig Mfg.: Spacewalker kit and catalogues for all
Sport Flyers Association: full insurance coverage
Yellow Aircraft: $250 gift certificate

**Here's the address of JPX, which sells the Turborec T240 turbine jet engine:*
***JPX,** Zone industrielle nord, 72 320-Vibraye, France.* ■

O.S. 120

(Continued from page 77)

loads has pushed O.S. to use a relatively retarded ignition point (by combining a low compression ratio with a large squish-band clearance). There's a limit to how far a manufacturer can go in this direction before the high-rpm/lighter-load end ends up with an ignition point that falls short of ideal. The high cylinder pressures combined with the *relatively* unmoving glow-plug ignition point have resulted here in a considerable narrowing of the useful rpm range to around 7,500 to 10,500rpm. Other glow-plug 4-stroke model engines have revealed much the same characteristic, but this engine brings it even more into focus. Ideally, one day, a variable-spark ignition version will do nicely, thank you.

After run-in, I concluded that:

- there's no point in using over-large wooden props; the engine will just throw them off with consummate ease;
- the prop nut and locking nut must be tightened very firmly, and a larger, thicker front washer helps with this. Attempts to load the engine down below 7,300rpm or so were usually counterproductive, and anything faster than 11,800rpm led to ragged running and a clear reluctance to go faster.

Use a prop of the recommended size (up to 14x14), and you'll see rpm in the area of 9,000

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O.S. 120

(Continued from page 96)

to 10,000—clearly in the engine's optimum operating range.

Irrespective of rpm, I have to repeat O.S.'s warnings against the use of *weak props*. The APC prop material and design seem fine, but others might not be. This has nothing to do with aerodynamics; it's solely a question of structural strength. We're entering danger areas here because the single-cylinder 4-stroke produces massive torque pulses.

This development was anticipated and is being met by the production of stronger props. Perhaps O.S. released this supercharged engine in a "de-tuned" form because it anticipated difficulties with the prop and hub driver; not because modelers might not be ready for the engine's power. After all, with ducted-fan and marine engines, we happily accept 5hp and more from 15cc 2-strokes. (There's the answer, though: lower cylinder pressures and less punchy individual power strokes from the much higher-revving 2-stroke.) Perhaps a multi-cylinder, 20cc, 4-stroke, pattern engine for F3A is now in the cards—as forecast some years ago. For now, as long as you follow O.S.'s instructions, you shouldn't have any problems; if you don't, you'll receive some swift engine-to-operator messages!

PERFORMANCE

Test 1. Open Exhaust. Fuel: 20 percent nitro/20 percent synthetic oil (ML70)/60 percent methanol. Plug: O.S.-type 'F' glow.

Some people are still anxious when it comes to choosing an oil for run-in. O.S. suggests: "For consistent performance and long engine life, it's essential to use fuels of the highest quality—ones that contain at least 18 percent lubricating oil. Lubricants may be castor-oil and/or an equivalent grade of synthetic oil. Before the engine leaves the factory, the carburetor is adjusted for a fuel that contains 20 percent nitro and 20 percent lubricant."

Remember that this is for their most highly stressed, slightly oil-deprived conrod big end.

I took O.S.'s advice to heart, and 20

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O.S. 120

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percent-nitro, 20 percent ML70 and 60 percent methanol seemed a good way to go.

In open-exhaust form, attempts to operate below 7,000rpm (to establish torque peak point more clearly) proved impractical. Likewise, at the high-rpm end, the precise horsepower peak was slightly unclear, and 12,000rpm proved to be an impassable barrier. The monitored supercharger pressure varied from 9 to 10psi over the tested range.

I soon saw the adverse scale effect of smallness on supercharger performance: the pressure reading went to zero when throttling back to below 5,500rpm (in full-size engines, pumping pressure is often available down to 2,000rpm or even less).

Test 2. Standard muffler. Fuel and plug as in Test 1.

With its 9mm entry diameter and 8mm exit diameter, the 1.3ci internal volume of this back-pressure muffler is small for a model 4-stroke. Its volume is roughly the same as the engine's capacity displacement. Bear in mind that a normal 2,000cc (122ci) car engine will often have a muffler that's around 500ci—three to four times the engine's capacity. This inevitably means superior muffling, because the exhaust energy is largely dissipated before it's released.

With this setup, slightly lower full-load rpm figures were possible, but the lower limit was definitely 6,600rpm. The only unusual performance feature was a noticeable recovery in torque beyond 10,000rpm to a point at which horsepower at 12,000rpm was slightly greater than in the open-exhaust test. Perhaps this was caused by a pipe back-pressure effect reducing fuel loss in the "valve-overlap" phase referred to earlier.

The O.S. claim of 2.5hp at 10,000rpm doesn't say this maximum. As this test showed, at 10,000rpm the claim seems to be conservative, and at higher rpm, even more horsepower is available (though the stated O.S. "practical rpm range" of 2,000 to 11,000rpm suggests that they'd prefer not to have their engine pushed above that point.

It became clear that this supercharged engine performs best at around 8,000 to 10,000rpm. Performance with a typical FAI pattern 4-stroke 14x14 prop sat nicely in the middle of that range.

Test 3. EX (extra quiet) muffler. Fuel and plug as in Test 1.

This muffler facilitates compliance with international F3A noise regulations. The maximum allowed is 94dB over grass, or 96dB over concrete, at a distance of 3 meters. With its larger entry and outlet diameters (12mm and 9.7mm, respectively), much larger internal volume (approximately 6ci—five times the engine's capacity) and 12-inch-long, flexible, metal, header pipe, it's bound to reduce noise. My checks showed a reduction of 3 to 5dB.

The muffler's size and volume should re-

O.S. 120

sult in less restriction, but the exhaust gas takes a convoluted route to exit (see 1/2-scale drawing). There was slightly less power available than when using the small, though straight-through standard muffler. At 50cc per minute, though, fuel consumption was less than with the other two setups, but never as low as O.S.'s claim of 40cc per minute. (No doubt, the difference is the result of differing interpretations of what it means to run the engine "slightly rich.")

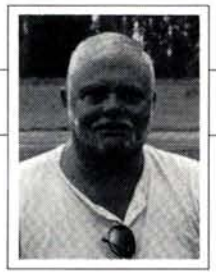
Using the 14x14 APC prop with the EX muffler, the engine easily obtained an idle of 1,850rpm, but 2,000rpm is probably more secure over longer periods of slow running. Acceleration from that point to full-bore operation was effortless.

TEN TIPS

- If you keep the F-120 as squeaky clean as it comes from O.S., all should be well. If you don't, you'll risk a commensurate reduction in reliability.
- The tightly fitting fuel pipe might survive, but I recommend the use of tie clips, or something similar, on all pipes.
- *Don't run this engine too lean.*
- To avoid injury—APC blades are sharp—

(Continued on page 107)

SPORTY SCALE TECHNIQUES



FRANK TIANO

Q & A MAILBAG

OVER THE LAST couple of months, I've received several letters asking questions that I thought most scale modelers already knew the answers to. Obviously, I was in error, and then I got to thinking that just maybe new people were getting into scale modeling and that maybe our segment of R/C was, indeed, not dying out. With this in mind, I compiled some of the most interesting questions and decided to answer them here for all of you. I've also decided that, from now on, I'll answer at least two questions a month in this column; all you have to do is send them to *Model Airplane News* (attention: Sporty Scale).

Neighborhood kids change the oil in Bob's smaller P-40.

MAIL CALL

Q I'm already a good builder and pilot. Should my first scale project be a .60 size?

A *When Dave Platt introduced us to large-scale models years ago, he proved that one very important concept was absolutely true: large models fly better! So, assuming that you can afford to purchase a large kit or plans and the expensive hardware that goes along with it, this is the wise choice. Larger models have a more forgiving wing loading and a larger wing volume. They're far more stable in flight than smaller models, and it's easier to practice detailing and weathering skills on them. By large models, I'm speaking of anything that weighs 17 to 25 pounds, has a 72- to 86-inch wingspan and can be powered by something like a Super Tigre 2500 or 3000, a Webra Speed 120, a Moki 2500, a Webra Bully 3500, or the O.S. 3500.*

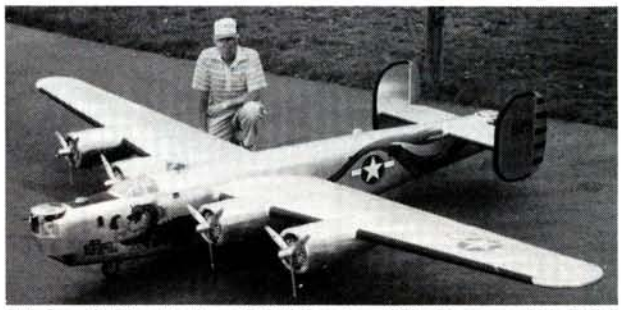
Q Is there an easy way to make hatches or landing-gear doors that really fit?

A *Yes, there sure is, and it's so simple that I just assumed everyone knew how. The first thing you do is apply Super MonoKote* over the hatch or door area. If possible, use a piece that's about 4 inches too big all around so that the area will be protected when you squeegee the resin off the glass cloth. (The MonoKote acts as a release agent and prevents the resin from sticking to the fuselage or the wing.) Cut out one piece of chopped-mat fiberglass, three pieces of medium (8- to 10-ounce) glass cloth and one piece of light glass-cloth, such as Dan Parsons* stuff. Make this little pile the same size and slightly larger than the hatch or the door. Apply a liberal amount of either Z-Poxy* resin or polyester resin to one piece of medium cloth, put it on the MonoKote where the hatch or wheel door will go and squeegee the resin through the cloth. Do the same thing with the chopped mat, followed by the two pieces of medium cloth and the one piece of light stuff. Squeegee the resin out of all these pieces so that you have several damp, but not runny, layers. Even though the resin cures in a few hours, it's best to leave this lay-up in place for at least two full days. Then, simply pop the finished piece of fiberglass off the MonoKote, and cut out the part. Cut the appropriate piece out of the fuselage or the wing, and install the glass part.*

Hank Iltzsch* made this magnificent 1/3-scale Sopwith Pup that was flown by Dick King at Cole Palen's Rhinebeck Aerodrome in Rhinebeck, NY. This photo was taken in Guntersville, AL—the site of the upcoming Aerodrome '92. There will be lots of real biplanes, and it has a fabulous museum. It should turn out to be a WW I Oshkosh! Contact Hank for more info.

Q Is it wise to use contest-grade balsa for my scale model?

A *Yes and no. Contest wood (sold by Sig* or Lone Star*) is wonderful stuff if you know where and when to use it. Remember that it's usually at least 30- to 50-percent lighter, and consequently weaker, than regular-weight balsa. I use it to make all*



Bob Campbell's extra-large B-24 Liberator—"The Dragon and his Tail." Span: 18 feet; length: 13 feet; weight: 165 pounds; engines (4): 2.4 Kioritz; construction: balsa-covered foam; finish: 0.005 aluminum; building time: 1,000 hours over five months.

tail feathers. I also laminate the main spar with 0.007-inch carbon-fiber strips from Violett Supply. For the main wing, I use 0.014-inch carbon-fiber strips to reinforce my 1/2x1/4-inch main spars and the smaller rear spars. Never use light wood for ribs; you're just asking for trouble. Ribs are made of medium-weight, sort-of-hard balsa. Leading edges can be made of light wood and, of course, all sheeting can be made of the light stuff as well. I use the light wood for areas of the fuselage planking that are aft of the CG, but I use stiffer stuff up front. All bulkheads should be made of medium-weight wood. Since I glass the entire airplane, the lightweight tail surfaces are very strong. The rule of thumb is never use contest-grade wood in any high-stress area. Pieces that don't have metal or hardwood attachments are great candidates for light wood.*

Fred Menna built this medium-size, 28-pound, 86-inch Sea Fury from Don Smith plans. Menna saw the plane in a Model Airplane News article about Top Gun '90. He had to have one! He used a Super Tartan twin and an 18x10 prop.

Q Should I use Mighty Lite* for firewalls and landing-gear mounts?

A *No! Mighty Lite and other light plywoods are meant to save weight in medium-stress areas. For example, they make great ribs, fuselage sides, doublers and servo-mounting platforms. Since they're only three-ply, they make very weak landing-gear mounts and firewalls. You must use a hard, five-ply sheet of plywood for any area that has an engine or landing gear fastened to it. Blind nuts will crush lite-ply, but they work very well with aircraft-grade five-ply wood. Mighty Lite is wonderful for fuselage bulkheads other than the firewall.*

Q Are three-blade props practical on large models? How about four blades? How can I determine which size to use?

A *Three-blade props are used on many scale models, and there are two types from which to choose. A three-blade prop that uses a two-blade-prop design with the blades fastened to a central metal disk can be inaccurate because, unless the blade is mounted at exactly the same distance from the center of the prop shaft, it will throw off the calculated pitch. In the designs I've seen, the center holes of the blades are usually moved outward from the center of the disk by some undetermined amount. A molded three-blade unit is far better, and there are several on the market (Graupner* is the most popular). As for which size to choose, it's relatively simple: just go down 1 inch in pitch or 1 inch in diameter. For example, let's say you have a 17-pound ME-107 (if you do, you're probably one in a million) with an O.S. 1.08 up front. Normally, you'd fly with a 14x8 two-blade prop, but a Graupner 14x7 three-blade will work just fine. In fact, thrust will increase and noise will decrease! If you have a 13x8 at your disposal, that three-blader would work well also. When you get up to 18-inch props, a larger reduction is in order. For example, if you're flying an 18x10 two-blade prop, try an 18x6 three-blade. It's different for four-blade props. On full-scale aircraft, big four-bladers are used to absorb as much horsepower as possible from those big engines. There isn't enough power in an average model engine to warrant the use of a four-blade prop; in fact, in most cases, performance would suffer. Remem-*

Here's proof that I did indeed build the Byron P-51 that I reviewed in the July '92 issue!

ber one very important thing: the most efficient model-airplane propeller in the world is a one-blade prop!

Q Is there an easy way to put the correct amount of toe-in in my tires? Is it true that this helps tracking?

A *Yes, and yes. First, adjusting your wheels so that they cant inward a degree or two is an excellent way to help your airplane track straight down the runway. The way to install this toe-in is simple. Set up the wheels so that they're absolutely straight, i.e., parallel to the center line of the aircraft, and find the exact measurement between them. Now, with a fine black marker, mark those dimensions on a piece of 1/4-inch sheet balsa, but don't cut it. With a large plastic protractor, mark off 2 degrees from each drawn line, and draw two more lines. These are the ones you can cut, and the resulting piece of wood will look like a trapezoid that will fit snugly between the two wheels. Have a friend hold the wheels against the piece of wood while you lock your struts or axles in place, and you've finished!*

Okay, that should give you enough flying-field talking material for a few weeks. Whaddaya think? Next month, I'll show you some great stuff from Top Gun, and I'll try to solve a few more problems. Until that time, if you're like the guy who wrote in saying he couldn't get my dummy radial to run, add more nitro. Your six is clear.

**Here are the addresses that are pertinent to this article:*

MonoKote/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

Dan Parsons Products, *11809 Fulmer Dr. NE, Albuquerque, NM 87111.*

Z-Poxy/Pacer Technologies and Research, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*

Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*

Lone Star Models, *1623 57th St., Lubbock, TX 79412.*

Bob Violett Supply, *1373 Citrus Rd., Winter Springs, FL 32708.*

Mighty Lite/FTE, *15300 Estancia Ln., West Palm Beach, FL 33414.*

Graupner, *distributed by Hobby Lobby Int'l., 5614 Franklin Pike Cir. Brentwood, TN 37027.*

Hank Iltzsch, *59 Sunset Dr., Seekonk, MA 02771.*

O.S. 120

(Continued from page 103)

treat yourself to a good electric starter.

- Avoid the use of wooden props with this engine. Use APC props and hubs or others of an *equivalent strength*, and always tighten the nuts firmly.
- Give the engine a few seconds to respond to main-needle and mixture-control-screw adjustments before you move them again.
- Use props of sizes that will keep the engine operating within a full-load, 8,000 to 10,500rpm range.
- If you use soft engine mounts, expect lower rpm figures than those I obtained.
- Seal all muffler connections with silicone glue to prevent unsightly leaks.
- To avoid the risk of running it too lean, *always run the engine slightly rich!*

SUMMARY

To assess O.S.'s achievement in producing this small, supercharged engine, remember the attempts of many others to do the same. There are many successful, "resonant wave," 2-stroke tuned-pipe model engines, but the model 4-stroke has suffered much more from "scale effect." O.S. just kept trying, and it has succeeded. *(Continued on page 130)*

video views

by JEF RASKIN

WING SKINNING

Subject: How to put balsa skins on foam wing-cores
Source: R/C City, 96 Railroad Ave., #F, Suisun, CA 94585
Summary: Educational, helpful, authoritative
List price: $29.95
Length: 25 minutes

Skinning foam-core with balsa skin is one of the finest ways of making light, precise wings for a wide range of models, from small gliders to 50-pound scale aircraft. I'm a local "expert" on the process; other fliers admire my wings because there are no glue lines, the leading and trailing edges are absolutely straight, and the finish is immaculate. I thought I was hot stuff until I watched this detailed tape. Here and there, they do the same things I do, but much more often, I learned how to do things better and even faster. These guys are pros. In future, my balsa-skinned wings will be better than ever. If you haven't done it before, this tape will get you off to a good start. It presents many error-preventing tricks.

Detailed information includes the weight of balsa sheeting you should use (e.g., a 1/16x4x36-inch sheet should weigh less than 14 grams), and the movie shows how to use 1/64-inch-thick ply in the center of wing tips (but it doesn't mention its use for making sharp trailing edges). Two other small disappointments: they seem to be unaware of the odorless, foam-compatible CAs, because they use only white glue on it. They don't mention the use of transfer adhesive tape instead of epoxy to bond the wing skins; it's a faster, easier method, and I've successfully used it for more than a decade.

I noticed just one error: only the ailerons are shown beveled, while the aileron cutout is left square. This allows the aileron leading edge to drop below the bottom surface of the wing when the aileron is lowered. It's better to bevel the wing and the aileron equally.

These small quibbles aside, this is a solid, instructional tape, which if followed, will help you to do a first-rate job of skinning foam wings with balsa. There's a little "sales talk," but it's unobtrusive. The only problem they *don't* solve for you is the high cost of balsa sheeting!

WRING IT OUT, VOLUME 1

Subject: How to fly R/C aerobatics
Source: Carl Goldberg Models Inc.
Summary: Fine exposition on R/C power-plane aerobatics; first of three volumes.
List price: $24.99 (plus $3 S&H)
Length: 30 minutes

Here's half an hour of sound advice and good-looking demonstrations from expert flier Dave Patrick. If a point is repeated, it's because it bears repeating and because too many fliers overlook it, e.g., the importance of having slop-free linkages. Patrick correctly emphasizes the "three Ps" required for flying perfection: practice, practice and practice. Volume 1 covers running a 2-stroke engine, landings, takeoffs, straight flight and elementary aerobatics. It might have been a good idea to show some "mistakes," just for comparison.

Well-produced and generally clear, the movie offers something to all but the most proficient fliers. There are a few small glitches, e.g., the angle at which the transmitter pictures were taken sometimes makes it look as if up-elevator is being held when it isn't. At one point, a maneuver is labeled a "split-S" (but I knew it wasn't), then a voice explains that the *next* flight sequence will be a "real" split-S. Better editing would have helped here.

Don't be put off by the fact that the movie is sold by Carl Goldberg Models; it isn't an advertisement and competitors' products are mentioned. Bravo!

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Marion Martin of Wofford Heights, CA, for correctly identifying the mystery plane in the June issue—the Consolidated C-87 Liberator Express. Built during WW II to carry key personnel and vital cargo to all United Nations' war theatres, the Liberator Express operated predominantly in the Pacific war zone. With a speed of more than 300mph and a range of more than 3,000 miles, the C-87 could carry a larger passenger or cargo load—more than 6 tons—than any mass-produced airplane of its time. Such notables as Wendell Willkie, Eddy Rickenbacker and FDR rode the Liberator Express. Marion was in charge of a crew who worked on this plane's wing center section and tail groups at the San Diego plant.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

PATUXENT FLYER
Pat Elmore, Editor
P.O. Box 1236
Solomons, MD 20688

PATUXENT FLYER
Patuxent Aeromodelers RC Club

In the June *Patuxent Flyer* newsletter, club president Mike Dean advises members to examine new approaches to noise reduction. To quiet a Quadra .40 gas engine, Mike replaced an after-market muffler with a stock Quadra muffler that he had modified by adding an interior baffle. He also replaced the 18x10 prop with an 18x8-14. This lowered the static rpm from 7,500 to 6,800, and it reduced the noise so effectively that "in the bottom of the loops, I can hear the airframe 'whistle' over the engine and prop." Mike suggests that modelers should think more about supporting a quieter way of flying, and we agree.

In "The IMAA Corner," Fred Nash writes about plans for the club to become an IMAA chapter, and Curt Givens' "Biggies" column discusses the IMAA philosophy and the benefits of flying big airplanes.

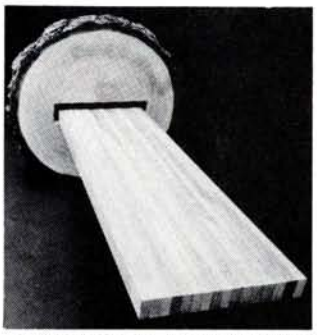
Also in the newsletter: "10 Ways to Learn to Fly Faster" by Tim Meranda; a short, helpful piece called "Fuel Tank Tips" (we agree with the advice about using a metal tube in the clunk line to prevent forward lodging of the clunk!); and a review of a fast, low-cost field charger. A letter from the president, the usual club announcements, a safety column and notes about new members and first solos complement these useful articles. We're impressed by the scope of the *Patuxent Flyer*, and we award two one-year *Model Airplane News* subscriptions to the Patuxent Aeromodelers RC Club.

PRODUCT NEWS

NEWMAN OPTICS
Zurich Sport Sunglasses

Made of safety glass, each of the Zurich Sport Sunglasses' contoured lenses fits closely and completely covers the eye area—even the side. They can be worn alone, or comfortably over prescription glasses. They block 98.1 percent of ultraviolet light and 100 percent of UV blue light, and they prevent your eyes from watering and protect them from wind-blown dust. When wearing the Zurich Sport, hard-to-see colors such as green, dark red and blue become more pronounced and therefore more visible.

Newman Optics, 5083 Ridgedale Dr., Ogden, UT 84403; (801) 479-7733.



PRECISION MODELING PRODUCTS
Precision Plank

This unique building board allows modelers to build straight and true. It's made of a special wood that's laminated in end-grain strips and "finger-jointed" to be absolutely flat. Pins can be inserted easily into the wood's fine, consistent grain (without the use of pliers, hammers, etc.). Precision Planks are available in two sizes: PP1—72x24x1 3/8 inches; PP2—60x20x1 3/8 inches.

Prices: $99.95 (PP1); $74.95 (PP2).

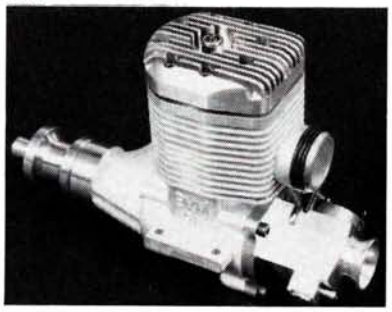
Precision Modeling Products, 19307 Palomar Pl., Tarzana, CA 91356; (818) 343-8858.

AVIATION HERITAGE BOOKS
Paul Matt Scale Drawings

The life's work of the late, great Paul Matt is now available in two volumes. More than 325 pages of three-view drawings show 124 types of airplane (from the most popular to the obscure), including drawings from the Golden Age, WW I, WW II, classic and modern eras.

Price: $24.95/volume (plus $3.50 S&H)

Aviation Heritage Books, P.O. Box 2065, Terre Haute, IN 47802; (800) 999-0141.

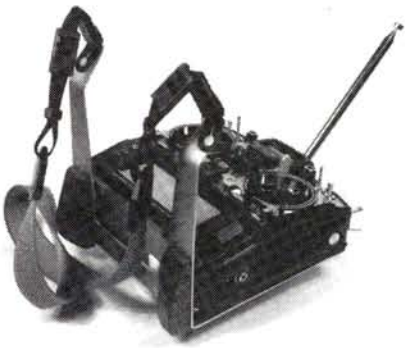


BOB VIOLETT
.91 Ducted-Fan Engine

Completely new in concept and design, this ducted-fan engine supplies maximum power with the minimum number of parts. The BVM .91 has a one-piece case with integral exhaust manifold. The carburetor body is machined as one piece with the drum-rotor backplate. The design's development was helped by tests during hundreds of flights; each part's performance, reliability and longevity have been maximized. Front spool adapters are available to fit the Violett or Dynamax fan unit, and the correct quiet-exhaust systems are available. The engine parts are precisely manufactured under contract by Nelson Competition Engines. Assembly, sales and service are handled by Bob Violett Models. Send $4 for the BVM Jet Information Pack.

Price: $500

Bob Violett Models Inc., 1373 Citrus Rd., Winter Springs, FL 32708; (407) 365-5869.

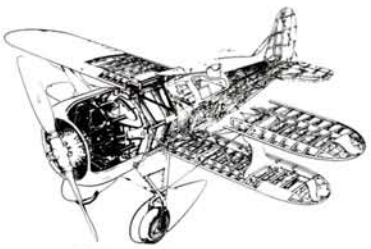


KDI
Stabilizor Transmitter Tray

The Stabilizor Transmitter Tray is among the lightest, easiest-to-use transmitter trays available. Used worldwide by top fliers, the Stabilizor offers the ultimate in precise control. Transmitter side buttons and switches are easily accessed. The comfortable, adjustable, neck strap has a non-slip inner liner and a quick-release mechanism.

Price: $49.95

KDI, 10426 SE 206 Pl., Kent, WA 98031; (206) 854-8053.



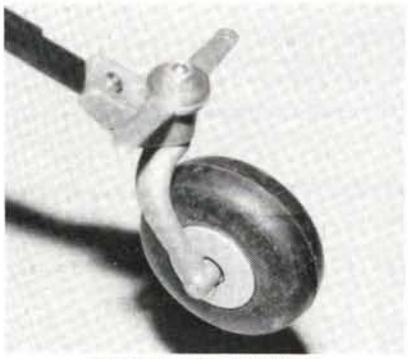
JIM NEWMAN
The Laird Super Solution

This limited-edition (500) 19 1/2x29-inch cutaway poster showing the Laird Super Solution is presented on heavy, cream, linen paper and printed in sepia ink. The main view is surrounded by smaller details, all with numbered descriptions. Professional illustrator and pilot Jim Newman has worked for British Aerospace, and during the last 20 years, his work has become well-known in almost all the modeling publications, including *Sport Aviation*. He's thoroughly familiar with his subjects and just as at home with Golden Age classics as with modern combat jets. Frame this unique poster, and hang it in your office or den. Only a limited quantity is left, and no more will be printed. Each is shipped rolled in a stout mailing tube.

Price: $20 (post-paid)

Jim Newman, 4 Cleveland Ter., Hobart, IN 46342.

PRODUCT NEWS



SCALE AVIATION
Tail-wheel Assembly

Based on the full-size Scott 2000 and Lang assemblies, this unit is used frequently on Piper J3 Cubs, PA-12 Taylorcrafts, Luscombes, Akromasters, Aeroncas and many more, including many popular home-builts. It can be used on many models up to 1/3 scale. The 2.6-ounce assembly features an investment-cast stainless-steel wheel fork and mounting bracket; smooth, 3/8-inch-wide spring-steel leaf springs; nylon bearings; and all required fittings, including the chains and springs.

Price: $52

Scale Aviation, 34 Ward Parade, Stirling Point, Bluff, New Zealand.

ROYAL
Expanded-Scale Voltmeter

This meter tests 9.6V transmitter and 4.8V receiver battery packs, and it has a built-in load to simulate working conditions in your receiver battery pack. A load feature allows you to time the discharge rate and receive accurate information on the operational time limits of your radio battery packs. The unit has a lifetime limited warranty. Banana-plug and wiring-harness options are available for test lead construction.

Price: $12.95

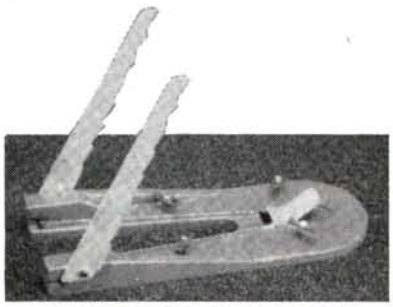
Royal Products Corp., P.O. Box 5026, Denver, CO 80217-5026; (303) 778-7711.

ASTRODATA
BATbug PCM

Attach the high-performance BATbug Programmable Charge Module (PCM) to your field box so you can quick-charge flight packs (airplane or helicopter batteries). Its large heat sink and dual circuits enable you to charge large-capacity batteries quickly. The ESV monitor (shown at left—not included) will keep you flying with your battery between half- and full-capacity.

Price: $55.95 through September

Astrodata, 60991 S. Hwy. 97 #5, Bend, OR 97702; (503) 389-2359.



LAUNCHER COMPANY
R/C Launcher/Pit Crew

The R/C Launcher and Pit Crew allows you to start, warm up, tune and release your model airplane without assistance. The main parts are made of 25-percent fiberglass-filled, fuelproof plastic, nylon or Ultem 2300. With the arms and levers locked, the arms have been successfully tested at over 250 foot/pounds of torque. The release arms can accommodate most rear stabilizers up to 1 foot high. Never worry again about starting an engine at full throttle in the pits.

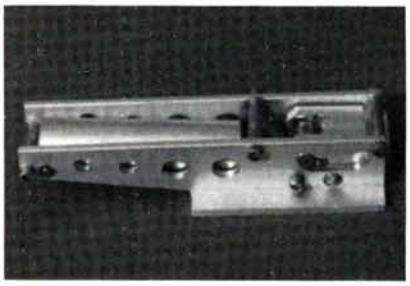
Price: $99.95

Launcher Co., 5806 Lancelot Ct. SW, Olympia, WA 98502; (206) 786-8461.

U.S. AIRCORE MODEL AIRCRAFT MANUFACTURING
Barnstormer 40

U.S. AirCore's Barnstormer 40™ is a super-tough .40-size biplane that's patterned after the famous WW II Boeing Stearman. An average modeler can build this bipe in a few evenings. It's four to five times more durable than balsa or foam kits, and it's impregnated with a vivid blue and yellow color, for a maintenance-free finish. To power and control this 50-inch-span bipe, you'll need a .40 to .50 ball-bearing 2-stroke or a .48 to .50 4-stroke engine and a 4-channel radio.

U.S. AirCore, 4576 Claire Chennault, Hangar 7, Dallas, TX 75248; (800) 336-0602.



GLENNIS AIRCRAFT
Custom Pneumatic Retract Units

Glennis Aircraft will custom-machine pneumatic retract units for unusual and hard-to-find applications. The locking retracts are machined from 6061 aluminum, and they have large-bore air cylinders to lift heavier landing-gear units. Custom rotating units are also available. Prices start at $295.

Glennis Aircraft, 5528 Arboga Rd., Linda, CA 95901; (916) 742-3957.

CLASSIFIEDS

Non-commercial Rate: 15 words or less, $4.50; additional words, 25¢ each. No charge for name and address. (No commercial ads of any kind accepted at this rate.) Commercial Rate: 50¢ per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. All ads must be paid for in advance. To run your ad for more than one month, multiply your payment by the number of months it is to run. Deadline: the 10th of the third preceding month (e.g., January 10 for the April issue). We don't furnish box numbers, and it isn't our policy to send tear sheets.

SEND AD AND PAYMENT TO: CLASSIFIED ADS, MAN, 251 Danbury Rd., Wilton, CT 06897 ATTN: Laura Kidder.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

1930s to 1950s MODEL AIRPLANE MAGAZINES; 1930s aviation pulps, complete and good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

START YOUR OWN HOBBY SHOP or buy for friends or group; 30 to 60 percent off. For information, send $1 and no. 10 SASE: R&L HOBBIES, 10334 Portage Rd., Box MAN, Portage, MI 49002.

HELICOPTER SCHOOL—5 days of hands-on instruction with X-Cell helicopters and Futaba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 160 satisfied students and 5,600 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C FLIGHT TRAINING CENTER, P.O. Box 727, Crescent City, FL 32112-727, or call (904) 698-4275 or fax (904) 698-4724.

GIANT SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

INTERNATIONAL AIRCRAFT RESEARCH—Need documentation? Include name of aircraft for availability of documentation with $3 for 3-view and photo catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

WANTED: your old proportional radios; interested in pre-1980, American-made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486.

JETS, the monthly newsletter for jet engines, Jet-X and pulsejets, $12 per year; $15 international. Back issues available. Catalogue, $5. DOYLEJET, P.O. Box 60311-A, Houston, TX 77205.

WANTED: Old unbuilt plastic model kits. Planes, military, figures, cars, promos. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192.

R/C HELICOPTER TRADER. Published every other week. Helicopters, parts and accessories. For free copy, send SASE to P.O. Box 702, Arlington, TX 76004.

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $2 for large list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

FOAM WING-CORES, floats, EPS blocks. All foam cut on Tekoa feather-cut system. Will cut to your specifications. Call or send to: SKY BLAZER PRODUCTS, 448 Vienna St., Newark, NY 14513; (315) 331-7464.

BUTTON-HEAD SHEET-METAL SCREWS—no. 2x1/2, $4.90 for 100; 4-40x3/4 alloy socket caps, $4.75 for 100. New, lower prices on metric socket caps. *Free catalogue*—contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (908) 806-4050; Fax (908) 788-2607.

NI-CD ANALYZER SOFTWARE for DOS. Ensure your batteries are delivering peak performance. Calculate capacity and plot discharge curves for voltage measurements collected during discharge tests. Complete instructions for collecting data and using program. Specify 3 1/2 or 5 1/4 disk. Send $20 to LAMANTIA PRODUCTS, P.O. Box 672, Station B, London, Ontario, Canada N6A 4Y4.

MODEL MAGAZINES (1930 to present): *Air Trails, American Aircraft Modeler, Flying Aces, Flying Models, MAN, RCM* and others. Complete sets and spares available. David L. Brown, 61 Coach Rd., Glastonbury, CT 06033-3237; (203) 659-2412.

SCALE MODEL RESEARCH Aircraft Documentation. World's largest. Over 3,300 different Foto-Paaks and 20,000+ drawings. Catalogue $4. 2334 Ticonderoga, Costa Mesa, CA 92626 (714) 979-8058.

PLANS ENLARGED—scanning/plotting services; Windsoft dot-matrix plotter. Free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

CRASH-RESISTANT composites; 120 types of aircraft, boats and rocket engine kits. Send three stamps to WILLAIRCO, 2711 Piedmont Rd. NE, Atlanta, GA 30305.

HAND-LAUNCHED glider: 16 1/2-inch wingspan; contest quality. All sanding and shaping performed; detailed assembly and flying instructions included; $7.50 plus $2 S&H. S&I Parsons, Rt. 2, Box 581-E, Hiawassee, GA 30546; (404) 896-4267.

MODEL MAGAZINES, send $1 for list. B. Apgar, 18 Mt. Joy Rd., Milford, NJ 08848.

USED ENGINES WANTED—ignition, glow, diesel. Send description and price for prompt reply. T. Crouss, 100 Smyrna St., West Springfield, MA 01089.

P/C—THE EASY WAY to simulate metal panels; $1 gets info and sample. Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857.

AVIATION VIDEOS—the video history of aviation available through our catalogue: WW I, WW II, Korea, Vietnam, Persian Gulf and more. Send $7.50 to Oranian Video, P.O. Box 852, Woodbridge, NJ 07095.

WANTED: complete engines/parts for airplanes, outboards, race cars prior to 1960. Wes Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003 or 907-0930.

VACUUM-FORMING—do it yourself! New, 128-page, illustrated book shows you how. Make car bodies, helicopter canopies, airplane parts and boat hulls. Start with ultra-low-cost, basic setup, or form up to 1/8-inch-thick plastics with innovative two-stage vacuum system. Make a high-vacuum source for less than $6. Eight chapters, including plastics, molds, heat and vacuum sources, tips and examples. It's easy; try it! $9.95 (plus $1.05 postage). VACUUM FORM, 272 Morganhill Dr., Lake Orion, MI 48360; or call (24 hours) 800-737-3000, ext. 2 ($1 surcharge on VISA/MC orders).

HELICAT CHOPPER: with O.S. .28FH engine. Flown four times, never crashed. Futaba 7FG/E, Gold sticker, five S138 servos. Both, $425; without radio, $300. GMP Cobra with O.S. Max .50, stock head, $350; without engine, $225. Bill Griggs, P.O. Box 815, Baldwinsville, NY 13027; (315) 638-2058.

COMPUTERIZED AIRCRAFT PLOTS: Technical illustrations suitable for framing. Three-views. Computer scale drafting and scanning services. Turn old prints into masterpieces! Catalogue, $1. D-TECH SYSTEMS, Rte. 2, Box 191-14, Carterville, IL 62918.

FREE BULLETIN BOARD: new electronic bulletin board for R/C modeling enthusiasts; 1200/2400 Baud support. (315) 652-5641.

HOBBY STORES—Orlando, Florida. Two great locations. Priced below cost with $59,000 down. Health forces sale. Great opportunity. Call (407) 682-9600.

CUSTOM-EMBROIDERED JACKETS, caps, patches. For 64-page color catalogue, send $2. Creative Sportswear, P.O. Box 158, Oley, PA 19547. Call (800) 444-9016.

SCALE DOCUMENTATION, plan enlarging; 140 superscale sport and giant R/C construction plans, three-views, cutaway drawings. Over 100,000 documentation photos in stock; 120-page catalogue, $5 ($10 overseas). Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. Visa. MasterCard.

PLANS: 112 1/2-inch B-36, 100-inch Constellation, 115-inch B-29—$30 each. Also, 135-inch B-24—$35. Add $4.50 shipping. John Murphy, 29 Cheryl Dr., Allenstown, NH 03275.

MAKE ME AN OFFER! Partially assembled Goldberg Eaglet 50; Airtronics VG6DR 6-channel radio system with four servos; Magnum .25 engine; many glow plugs and propellers; 12V battery/charger; power panel; expanded-scale voltmeter; Ultra tote box; engine starter; plus all finishing supplies and many, many extras. All items are brand-new! Make me an offer! Send your bid to Jacob Lakhany, 1117 NE 6th Ave., Aberdeen, SD 57401 (by September 30, 1992). I will pay postage to send everything to highest bidder!

AIRLINE PILOT CAREER GUIDE leads you from casual interest to a career as a commercial airline pilot. Logical career-path steps written by active airline captain. Get started today! Send $12 to Aviation Pursuits, 4566 Kettering Dr., Roswell, GA 30075.

ACE RADIO STEAL—Micro-Pro 8000 Metal Sticks 4.0 (latest), software, all bells/whistles; NIB; $325, delivered. Kevin (206) 854-8053.

CONTROL-LINE AND R/C kits cut on per-order basis. Send SASE to: Repli-Kit, P.O. Box 1412, Inverness, FL 32651-1412.

NORTHROP GAMMA on floats and wheels: 9 1/2-foot wingspan, 6-sheet plans. Also, 132-inch Blohm and Voss BV-138 and Blohm and Voss HA-139 4-engine on floats. Details and photo for two stamps. Gene Falada, Sea-Clusion Aeronautics, 22W070 Byron, Addison, IL 60101.

BALL BEARINGS for engines; high-performance, class 3/PG with polyimide, phenolic, or steel retainers. Sold in sets or individually, SASE for price list: REVMOR, P.O. Box 548, Palm City, FL 34990; (407) 283-6831 after 5.

NONE BETTER IN THE UNIVERSE! The best VHS flight-instruction tapes available anywhere! *Silicon Valley R/C Technologies* (800) 822-1500.

MAGAZINE COLLECTION for sale: 20+ years of *MAN, RCM, MB, MA, AAM, Wings, Air Power* and more! Send long SASE for list. Tony Avak, 114 Atalanta St., Lexington Park, MD 20653.

MUTUAL INTEREST in exchange of experiences had with model-aircraft activities. Write: Atelier-Group, JC2OA, P.O. Box 247924, Columbus, OH 43224.

FOR SALE: all-new kits. Concept Big Fleet, $125; Bud Barkley 1/4-scale Tiger Moth (includes F/G cowl and tank), $125; Balsa USA Flybaby, $90; Balsa USA Aeronca C-3, $90; Sig Astro Hog, $50; Dave Platt 60-inch Waco-YMF-3, $50; Hobby Lobby Senior (96 inches) Telemaster, $95. Includes shipping. Mel Blair, 9 Greenway Dr., Middle Island, NY 11953; (516) 924-4661.

IMPORTED DIESEL ENGINES—AE, Aurora, Cipolla, D-C, KMD, MAP3, MIKRO, MK, MVVS, PAW, Pfeffer, Silver Swallow and USE. Also replica Letmo, Mills and MOVO diesels and rare imported glow engines and CO_2 motors. Ten-page catalogue, $1. CARLSON ENGINE IMPORTS, 814 E. Marconi, Phoenix, AZ 85022.

O.S. 120

(Continued from page 107)

That this first commercial supercharged model engine has a narrower rpm spread than some others is of little consequence for F3A competition. In those events, the 2-stroke tuned-pipe unit produces its results from a markedly narrower rpm range over which correct pipe resonance occurs. Also, these are early days (they always are!), and we should expect further developments.

The engine's quality really sets it apart. At the end of my tests, it seemed to be in good working order, but I needed it for further duty, so I didn't dismantle it to check the inside.

CHARGER

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play), you can force the charging rate of any channel from the standard C/10, 16-hour rate, to a C/40 charge/trickle rate.

CONCLUSION

The Ultimate Charger is a very useful battery-maintenance system that I highly recommend. Sometimes, it's the little things in life that make you happy. I like the fact that the batteries in my airplanes are always fully charged and ready for flying,

**Here's the address of the company that's featured in this article:*
***SAI**, 27107 Richmond Hill Rd., Conifer, CO 80433; (303) 838-6346*

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